PROGRAM MANAGER

Dan Czelusniak on Program Stability

1997 Acquisition Research Symposium

Naval Postgraduate School

"Don't Become What You Were Established to Overcome"

Know the Customer

Manage Risk

Involve the User

Challenge Time Lines

Train the Workforce

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Give PMs Authority

GARY SMITH, SOCOM ACQUISITION EXECUTIVE

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Corrections

In our July-August 1997 issue of *Program Manager*, the photo caption on the extreme right of p. 89 contains an incorrect name: "Linda Black" should read "Mary Black." On p. 36, the photo caption at the bottom of the page should read "U.S. Navy Multifunctional Information Distribution System (MIDS) Program Office (Communications-Computer Systems Integrated Product Team). The photo caption at the top of p. 37 should read "U.S. Special Operations Forces Intelligence Vehicle Program (SOF IV) (Program Management Integrated Product Team).

Program Manager Interviews Gary Smith, SOCOM Acquisition Executive

"If We're Going to Manage a Program on the Same Schedule As One of the Services, We're Not Doing Our Job"

COLLIE J. JOHNSON

Mention special operations forces and most people conjure up an image of a covert, John Rambo-like character, known by various names throughout the armed forces: ranger, snake eater, SEAL, or night stalker. In Gary Smith's mind, "Rambo" is no more. The special operations forces operators are quiet professionals, who do their jobs under very demanding conditions. By nature, this customer wants everything they need for the mission, they want it quickly, and they want it at a reasonable price. Who can blame them, when they are representing the very unique needs for special operations forces worldwide – men and women who face new, quick-reaction missions, bigger challenges, and certainly bigger risks, all in a day's work. Justifiably, they expect their government to procure the best systems and equipment necessary to the success of their missions – now.

Gary Smith was ready to take on new challenges when the opportunity came. After 20 years of working as a chief project officer; engineer; deputy project manager; project manager; and Program Executive Officer, Aviation, in St. Louis, he was tapped in 1991 by Army General Stiner to be the first Acquisition Executive for the Special Operations Command (SOCOM) at MacDill Air Force Base, Florida. The transition from a GSA warehouse-type building at the Federal Center in St.

GARY SMITH, SPECIAL OPERATIONS COMMAND ACQUISITION EXECUTIVE AND MEMBER OF THE SENIOR EXECUTIVE SERVICE, IS INTERVIEWED IN HIS MACDILL AIR FORCE BASE, FLORIDA, OFFICE BY COLLIE J. JOHNSON, MANAGING EDITOR, *PROGRAM MANAGER* MAGAZINE.

Louis, to the beautiful Florida West Coast was, according to Smith, a "radical but welcome change." But that wasn't the only thing motivating Smith.

In selecting him as the SOCOM AE, General Stiner handed him the biggest challenge of his career. Little did Smith realize, his tenure at SOCOM would coincide with an unprecedented jump in our nation's special operations forces' utilization rate – Northern Iraq, Somalia, Haiti, Rwanda, Bosnia, Liberia – our daily headlines tell the story.

Since 1992, special operations forces deployment rates have increased 127 percent. Smith's job was and is to prepare for and meet the equipment and systems requirements of these short-

Johnson is Managing Editor, Program Manager magazine, Visual Arts and Press Department, Division of College Administration and Services, DSMC.

fuse and other deployments, ensuring that U. S. Special Operations Forces (Army, Navy, and Air Force) have the equipment and systems where they need them, when they need them.

Operating with four chartered PEOs, a combined staff of only 126 government personnel to manage all special operations-peculiar acquisition and technology programs, Smith's pride in his small but talented workforce pervades the interview. *Program Manager*, in this issue, attempts to present our readers a small glimpse into what it takes to manage the acquisition program for our nation's special operations forces. By its very nature, the Special Operations Command and its acquisition programs must remain a sensitive operation. Most of this story remains untold — and rightfully so.

Program Manager: Some of our readers may not be aware of or fully understand the unique operating environment which led Congress to give the Special Operations Command acquisition authority equal to the Services. Could you explain how and why this came about?

Smith: The Command stood up as a result of the neglect of the Services to fully resource and provide for the training and equipping of special operations forces across our Army, Navy, and Air Force; and because of the failed Iranian hostage rescue attempt, DESERT ONE.

The USCINCSOC [Commander in Chief, U.S. Special Operations Command] has his own budget and acquisition authorities. With the type of missions and actions that SOCOM has to perform, the Congress desired that we be able to move out faster on development and equipment purchases. There also was a desire for Acquisition Reform and streamlining. As a result, the Congress gave this Command its own acquisition authorities and its own budget, Major Force Program (MFP) 11.

Program Manager: Describe for us, please, what you see as some of the criti-

We have a strong, healthy internal competition here between our PEOs and PMs — each tries to outdo the others in managing a program faster, better, and cheaper. We have a very dedicated and close-knit program management and procurement team on each of the projects, so it's a real team effort.

cal roles identified thus far for the special operations acquisition workforce.

Smith: One of the most critical considerations, I think, is that we have to know our customer very, very well. Our customer base, our warfighters, are demanding, and they're very impatient with the development and acquisition community. They have unique requirements compared to the larger Services. The missions they execute are planned and tailored, but they must be able to change operations

rapidly. Therefore, our acquisition people must have a high degree of involvement with their user community, our customers. But it's also critical that we control how much the user impacts our acquisition efforts, so that we don't get significant requirements changes during the mid-course of an acquisition program. We typically operate with short development cycles, much shorter than the Services.

Another critical consideration comes to mind. We have three Component Commands: Army, Navy, and Air Force. We must prevent duplication between those components. We can't allow each component to go out on their own and buy the same equipment; that would result in individual buys that are more expensive. We need to do economic, order-quantity buying.

Program Manager: In preparing for this interview, we learned that you operate with four chartered PEOs, with a combined staff of 126 personnel to manage all special operations-peculiar acquisition systems. Given the rapid deployment environment, starting with DESERT STORM, and escalating since 1992 — Northern Iraq, Somalia, Haiti, Rwanda, Bosnia, Liberia — we're amazed. How are you resourcing and modernizing special operations forces with the best and most affordable equipment with such a seemingly small staff?

Smith: Yes, I have an authorized strength of 126 personnel, military and civilian. To be able to execute this mission we use SETA [Systems Engineering Technical Assistance] contractors to augment our very small PM offices. We normally only have two or three government employees staffing a PM office. We also use other government employees from the Services' commands, centers, and laboratories to come here on temporary duty to help us execute the programs.

Our people work very hard, and they often work long hours. They are very dedicated because they have a real closeness with those who execute the

GARY L. SMITH

Acquisition Executive
U.S. Special Operations Command

Gary L. Smith is the Special Operations Acquisition Executive, U.S. Special Operations Command (USSOCOM), MacDill Air Force Base, Florida. Smith transferred to USSOCOM in October 1991, and is currently responsible for all special operations forces research, development, acquisition, and procurement.

Smith was born in Peoria, Illinois, September 24, 1941. He received a bachelor of science degree in machine design from Bradley University in 1963. After graduation, he was commissioned in the Air Force through the Reserve Officer Training Corps and subsequently assigned to Eglin Air Force Base, Florida. Smith served as a Project Engineer and Branch Chief, responsible for testing and qualification of Air Force weapons systems in support of the Vietnam War effort.

In 1968 he began his Army civilian career at Rock Island Arsenal, Illinois, where he managed the development of the AH-56 helicopter gun systems. He transferred to the Army Aviation Systems Command in St. Louis, Missouri, in 1971. With the start of the AH-64 Apache Program, Smith developed the conceptual design and specifications for the complete mission equipment package, including armament, fire control, and avionics subsystems.

In 1975 he earned a master of arts degree in business management and was advanced to Senior Mechanical Engineer. He became Chief Engineer of the TADS/PNVS project in 1977, responsible for all technical aspects of the electro-optical and fire control systems. Smith then became Deputy Project Manager for Aircraft Survivability Equipment in 1980, responsible for acquisition management of the Army's airborne electronic, electro-optical, infrared, and optical countermeasures programs.

Smith was promoted to the Senior Executive Service in 1984 as Director of Advanced Systems, U.S. Army Aviation Systems Command. As Director, he planned and orchestrated the command's research and development program, including conceptual design of new aircraft.

In February 1988 he became the Deputy Program Executive, Aviation, for the Army; and in September 1989 he became the Program Executive responsible for all Army major aviation programs, including the AH-64 Apache, UH-60 Blackhawk, OH-58 Kiowa Warrior, CH-47D Chinook, MH-60K and MH-47E Special Operations Aircraft, AH-1 Cobra, Aircraft Survivability Equipment, Aviation Life Support Equipment, and the Air-to-Air Stinger.

Smith is married to the former Ida Kavanagh of St. Louis, Missouri. They have three sons.

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missions. They also receive rapid feedback from the operations that SOCOM executes. We try to be very selective in hiring very highly skilled and experienced personnel. The military slots are Joint-Service billets, so our people get credit for a Joint assignment when they're filling one of these critical acquisition positions.

Program Manager: It sounds as though SOCOM pretty much gets the "cream of the crop" when it comes to staffing.

Smith: We're fortunate. The Services nominate military acquisition professionals to fill SOCOM's vacancies. The selected individuals receive both acquisition and Joint credit. We are also very selective in filling our civilian vacancies. We have limited our bureaucracy here. We are still new enough to not have all the in-place bureaucracy to contend with. We don't have checkers that check the checkers. We have a very short reporting chain to get the decisions.

Program Manager: That must make your job a lot easier...

Smith: Yes, it does in many ways. We also have strong congressional support. Since we were a creation of Congress and are so involved in operations all over the world, I think Congress feels an obligation to treat us quite well.

Program Manager: May I ask you, since you mentioned Congress... despite your small staff and special mission, are you still subject to all the DoD-directed and legal requirements for acquisition systems?

Smith: Unequivocally, yes. I must comply with all the FARS, DFARS, and Department of Defense directives. We even have our own implementing directives. As far back as five years ago, the DoD 5000-series directives allowed acquisition streamlining, but there was not a real emphasis or incentive to go out and do it. Since there was little reward, it really took someone with guts to do it. Things had to change.

Program Manager: And that catalyst for change was Dr. Paul Kaminski?

Smith: Yes and, actually, I think it began even before Paul. I believe Dr. Perry directed some of this initial start-up in the area of Acquisition Reform. And, of course, the Congress also wanted it to happen. SOCOM was told upon creation, "Don't become what you were established to overcome." I think that fits our acquisition system thrust very well.

Program Manager: Dr. Perry said in a speech at the Acquisition Hammer Awards last year that Acquisition Reform had been talked about for years, but it was something that people put in the "too-hard-to-do" category. He said it gave him great satisfaction to be serving as Secretary of Defense during a time he could actually see reform taking place and be a part of it.

Smith: Acquisition Reform was indeed long overdue. Here at SOCOM, it's worked out quite well. We started implementing Acquisition Reform when I first came here from the Army.

We, in the Army, had a large bureaucratic system that was operating in the era of total risk aversion. We had to put additional time and money into programs to avoid risk. It later proved out that the additional time and money was not always required. But to get a program through the development process and get it through an OSD DAB, you had to put the additional time and money into the program, needed or not. Risk aversion has now been eliminated; we now evaluate risk up front and then manage that risk.
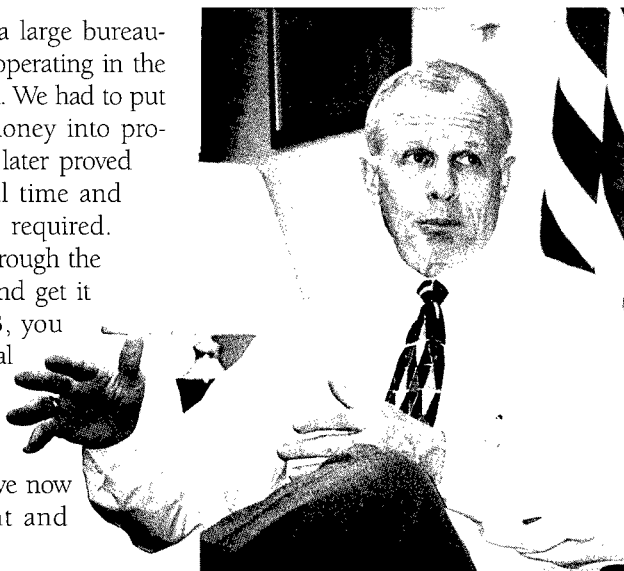
Program Manager: Special Operations also has some unique procurement processes and intense management procedures to streamline the procurement process. Can you briefly describe those processes and management procedures that are unique to SOCOM?

Smith: One of the first things we do is determine the criticality of the program and whether we will manage the program at SOCOM or whether we will ask one of the Services to execute it for us. Approximately 70 percent of our projects are out-sourced to the Services for execution. To make this determination, we go through a matrix evaluation process.

The second thing we do is ensure that the real users are involved, not just representatives of the users, but the SEALs, the Green Berets, the Rangers, or the Aviators out in the field. They get involved in the up-front planning and the writing of a performance specification for the equipment.

The third thing we do is an intense market survey to determine what kind of equipment is out there to satisfy our requirement. Optimally, we desire to find something that's a nondevelopmental item that we could just modify instead of having to start from the very beginning.

Next we do a good risk assessment up front to determine what the risk areas

One of the most critical considerations, I think, is that we need to know our customer very well. Our customer base, our warfighters, are very demanding, and they're very impatient with the development and acquisition community. They have unique requirements compared to the larger Services. The missions they execute are planned and tailored, but they must be able to change operations rapidly. Therefore, our acquisition people must have a high degree of involvement with their user community, our customers.

are so that we can plan the schedule. Knowing the areas that are high-risk allows us to program the additional effort in the right areas. This also helps us determine where we're going to enter the acquisition cycle, whether it be Phase zero, one, two, or three in the process. We also almost always combine Milestones, be it MS I/II or II/III.

We constantly challenge the time lines. Whenever one of the PMs puts a program together, we wire brush the schedule to determine if we can possibly accelerate it any more than has already been proposed.

We have strong, healthy internal competition here between our PEOs and PMs — each tries to outdo the others in managing a program faster, better, and cheaper. Lessons learned are shared. We have a very dedicated and close-knit program management and procurement team on each of the projects, so it's a real team effort.

Program Manager: Teaming is certainly one of USD(A&T)'s strong initiatives. Yes, it appears your activity has been one step ahead of the game in working Acquisition Reform before it became institutionalized.

Smith: We were trying to. And now that it's basically mandated that we do Acquisition Reform, I have a lot of support. Our people have a great pride in executing programs in a streamlined manner.

We have strong CINC support. I work directly for General Shelton, the CINC, and he strongly supports our acquisition mission. One of the things that we've been able to do with his help is stabilize the funding on our major developmental efforts; that's a great help in executing these programs.

Program Manager: We just had a briefing by Daniel Czelusniak, Director of Acquisition Program Integration, USD(A&T), who came to our College and spoke on that same subject —

program stability. He sees funding instability as a force working against Acquisition Reform. What I got out of his briefing was that funding stability is the exception rather than the rule for any number of reasons. Is program stability a major problem for SOCOM's acquisition program?

Smith: With the large, major acquisition programs where you're subject to a lot of OSD Comptroller review — yes, that can be true. SOCOM has the advantage of being outside the Beltway, which by its nature translates to much less oversight from OSD. Also, we do not execute any ACAT-I programs here. Our ACAT-I programs would be executed by the Services for us. I don't have the staff to stand up a 100-person PM office with a capped staff of only 126 people. Our ACAT-IIs and IIIs don't get the same amount of outside oversight. Significant outside oversight would prevent us from doing rapid acquisition, period.

Now, we do get cut on some of our projects since we fall under the Defense-wide Agencies, but we've also been "plus'd-up" with funds from the Congress. We have experienced congressional help in plus-ups in RDT&E and the Procurement accounts; that helps. What I am able to do is establish programs for which we will absolutely maintain funding stability, with no cuts to those programs. If the OSD Comptroller cuts one of those programs, I then have to find funding to move back into the program out of something else.

Program Manager: Your candid assessment – have the Acquisition Reform initiatives out of OSD helped you manage your acquisition program better?

Smith: Acquisition Reform, to me, has been a definite help. As I earlier indicated, we had a mindset of total risk aversion throughout OSD and throughout the Services. That had to change.

Since Acquisition Reform was initiated, we have a better educational sys-tem in place. DSMC has added courses. They're doing a much better job since the emphasis at the top is to improve the training of our acquisition workforce.

The PMs now know that they are accountable and have the authority they need, in addition to the responsibilities that they previously had. People are now being empowered more than they were previously.

Key to our present state was strong support from Dr. Perry and Dr. Kaminski to implement and institutionalize Acquisition Reform.

Program Manager: You mentioned risk-aversion. Dr. Kaminski recently made a statement that stayed with me. He said that there are situations where people have taken prudent risks, done some good things, and for whatever reason, it didn't work out. He called them a category of people he's looking for and wants to reward. Do you reward your risktakers, even when it doesn't work out?

Smith: Yes, our military are rewarded with honorary awards, and the civilians are rewarded with monetary and honorary awards. They don't have too much of a chance to determine whether they're going to take risks because we demand that they shorten all their acquisition schedules — and the user demands it. They [special operations forces] have important needs where they require the equipment fast. There's a mindset here, that if we're going to manage a program on the same schedule as one of the Services, we're not doing our job.

Program Manager: It seems like every time you pick up a newspaper, our special operations forces are deploying somewhere else — Northern Iraq, Haiti, Rwanda, Somalia, Bosnia. It's just a given that the special operations forces utilization rate is rising. Do you have any numbers on that? It has to be a dramatic increase.

Smith: Yes, it is. Since 1992 we've had a 127-percent increase in our deployments. We're normally deployed to

about 60 different countries each week. You don't hear about and shouldn't hear about all the deployments that we're doing. Some of those deployments might only be one person, but most are much larger. We often go into countries before the real hostilities start. We attempt to influence things so that it doesn't turn into a shooting action.

The reason for the increased deployments is our forces are so uniquely qualified for today's geopolitical environment. They're uniquely language-trained and culturally oriented on the country, and superbly prepared to execute their military skills.

Program Manager: Since the deployment rates for special operations forces personnel have risen dramatically, obviously your workload has gone up. Is SOCOM, particularly its acquisition workforce, being "beefed up" with increased staff to meet this increased demand?

Smith: On the acquisition side, since 1991 when we started our acquisition organization, we have grown. The organization started with five people, then it grew to about 50 people, and today we're up to 126. We have not grown any since 1994, but we've taken on a lot of additional work since then.

Program Manager: And you're meeting requirements by augmenting your staff with contractors, temporary assignments, and other Service personnel?

Smith: Yes, full-time and temporary reimbursable government employees, as well as support contractors. We're mostly doing more with the same number of personnel and trying to do it smarter and better. I'd like to do even more work here. Instead of outsourcing 70 percent, I'd like to do more of our work here. But I just don't have the resources to do that; we're JCS-limited in the number of people that can be assigned to the total Command. And that's why I've had to resort to other means to augment our workforce.

Program Manager: This is one government employee who would jump at the chance to volunteer for a temporary assignment on such a beautiful base, in sunny Florida.

Smith: Most people would. In addition to our beautiful geographical environment, SOCOM is a very challenging acquisition working environment. So we get the best of both worlds.

Program Manager: Let me turn the subject to technical integration. Where is SOCOM in getting all the right systems meshed together to become completely integrated with the other Services? Are we getting to that point?

Smith: We have many unfilled requirements, but we've made good progress in filling most of the vitally important requirements in weapon systems. Our technology developments are very integrated with the Army, Navy, Air Force, and the National Laboratories. We also have projects with the Department of Energy and DARPA [Defense Advanced Research Projects Agency]. We develop memoranda of agreement with all of these folks so that we can leverage some of the projects that they're executing which have application to our requirements. We might put $100,000 on a program where, perhaps, DARPA was spending $2-3 million, and then use our money as leverage to change the development slightly, to meet our special operations forces-unique requirements. That strategy has been quite successful for us and DARPA.

Program Manager: As special operations forces move into more uncharted territories like Rwanda and Bosnia, the demand for specialized communications, intelligence resources, and weapon systems is going to grow. Likewise, we're going to need more trained people to develop and procure this new equipment and these new systems.

We'd be interested in hearing about the education and training of your acquisi-

It's [DSMC] just a superior school, and they have a superior staff of instructors to conduct the courses. I've never seen a bad instructor at DSMC.

tion workforce to meet this ongoing and future monumental requirement.

Smith: As you know, special operations forces are normally the first into these countries. In fact, many times we're there before any substantial requirements evolve for the United States. When we're in these countries, we're supporting the American Ambassadors and their country teams.

Our civilians are in the OSD Acquisition Corps, sometimes called the fourth estate. Our military acquisition professionals are in their respective Service's acquisition corps.

OSD has been very generous in allocating training slots to us. Ninety-one percent of our people are certified at the various levels, with an increasing

number certified at Level III. Another training area, which we view as absolutely vital, is the need for our assigned military, even the more junior military, to be graduates of, or attend en route, the PMC [now APMC] course at DSMC. And then the other way that we train our people is that they learn a lot here in the school of hard knocks.

Program Manager: That's a tough one. I've been to that school.

Smith: Things have really changed. The first formal course I ever attended at DSMC was the Executive PM course. I went back later and took some of the short courses. This was not the right order of training: hard knocks, executive course, then detail short courses. Training is more disciplined today.

Program Manager: As long as we're talking about DSMC, is there anything that DSMC, in your mind, can do to further meet the training needs of your acquisition workforce?

Smith: I guess at this point I'm going to sound like a paid commercial for DSMC, but I think DSMC is a premier education facility, from the short courses through the long PM [APMC] course, and on to the executive courses and GO/Flag Officer course.

The executive courses are particularly good. I do, however, think there's a few areas for improved training. The first one is more training for the acquisition workforce on how to execute the non-major programs – the ACAT-II and -III programs. I say this because the majority of DoD programs are non-major. Some of the students come back from the APMC course and say that they'd like to hear more about how to execute the non-major programs in lieu of the majors. In reality, there just aren't that many ACAT-IDs around today.

The second area would be more emphasis on risk evaluation, risktaking, and how to manage risk. Some

of the students also tell me that they'd prefer to have more case studies on how successful programs were run instead of so much emphasis on the failed programs and why they failed.

Program Manager: You certainly called it right — we couldn't ask for a better commercial. And we're holding a marketing job just for you.

Smith: I do feel that way about DSMC. It's just a superior school, and they have a superior staff of instructors to conduct the courses. I've never seen a bad instructor at DSMC.

Program Manager: Can I divert your attention now out to the West Coast. I'd like to talk briefly about Force XXI. Did you have any involvement in that exercise?

Smith: No special operations-peculiar equipment was tested at Force XXI. However, our Special Forces did participate with some Army common equipment.

Most of our systems are tested in other exercises. We participate in all the JRTC (Joint Readiness Training Center) rotations. We participate in JCETs (Joint Combined Exercise Tests) in other countries in support of the warfighting CINCs.

An example is the recently completed CENTCOM ROVING SANDS Exercise that was conducted here in the Southwest Desert. SOCOM's TENCAP office tested two systems: Town Crier and Steel Rattler. These were digitized sensing, processing, and information reporting systems in support of reconnaissance to counter SCUD missiles. The equipment performed very well, but I cannot discuss any of the details due to the sensitivities that would be involved.

Program Manager: There's a lot being written about special operations forces medicine, especially since the opening of the Special Operations Medical Training Center at Fort Bragg. Can you tell us what type of medical systems and equip-

ment will support a wounded warfighter on future battlefields?

Smith: The Special Operations Medical Training Center at Fort Bragg is a USCINCSOC-resourced and -controlled facility. It provides special operations-specific training for Army, Navy, and Air Force medical personnel. Its focus today is on enlisted medical personnel training, but it's going to be expanded later to medical officers and medical support personnel.

Program Manager: When you say "special operations forces medical personnel," do you mean that special operations forces have their own medical personnel who accompany them on missions?

Smith: Yes. Every Special Operations Forces A-Team, which is a 12-man team, has one medical corpsman with them. Because they operate in small teams and are often in very dangerous situations with high risk for injuries, they take their medical support with them.

We also have a medical modernization technology initiative that supports our wounded warfighters. It places the emphasis first on protection and performance enhancements to preclude or minimize any injuries.

We also provide medical support for civil affairs and humanitarian assistance for indigenous populations in other countries.

We spoke earlier, prior to this interview, about the popular, so called "snake-eater" or "Rambo" image of the special operations forces. And yes, we certainly have the capability to do the "Rambo" kinds of things. But I can tell you, the majority of the efforts that we support are civil affairs, psychological operations, and humanitarian assistance. That's what our forces are doing around the world every day as Quiet Professionals.

Program Manager: How about the outcome of the QDR? Were there any surprises for you?

Smith: There's a couple areas in the QDR that will affect us. One is the takedown of two reserve Special Forces battalions.

One of the other things that the QDR addressed was Counter-Proliferation of Weapons of Mass Destruction [CP/WMD], which Dr. Perry assigned as a SOCOM mission. It is one of our priority missions, and it's going to require significant new developments. I believe that there was about $1 billion directed and dedicated to that effort. We will not get all that money because the Services also have requirements. CP/WMD is one of our highest priority missions.

The QDR was good to us from the aspect of the world environment today — the kinds of things that have to be executed by the military today are right in line with the type of actions that SOCOM executes. We anticipate being very well-employed in future world operations.

Program Manager: It appears Congress is giving you the money you need to do the job. Overall, would you say you're well funded?

Smith: No, we have shortfalls. But I won't make a commercial for acquiring more funding in this article. We have a budget of about $3.2 billion per year. Keep in mind this $3.2 billion includes all the military pay, civilian pay, the O&M, the RDT&E, and Procurement. I only have about $140 million in RDT&E, and about $600 or so million in FY97 Procurement. It's not that big of a program. We have many more requirements than we have funding for. And that's why Congress keeps helping us and giving us some of the additional funding we need.

Program Manager: Many of our readers are probably wondering — Is Gary Smith a former night stalker, snake eater, ranger, or SEAL? What kind of background qualifies a person for so unique a position?

Smith: I'm none of the above. I was never assigned to special operations

forces while on active duty. I started off as an Air Force second lieutenant right out of college as a flight test project engineer. My entire career has been in the government as an acquisition professional.

I left the Air Force as a captain and went to work as an Army civilian. I've been a project engineer, a program chief engineer, a Deputy PM, a PM. I was the Director of Advanced Systems for the Aviation Systems Command for about three years. I was a Deputy PEO, a PEO, and then I came here as the Acquisition Executive. I've done this all my working career — and it's been a good life.

Program Manager: One last question — Were you given any advice and counsel when you took this job that has served you well? Who gave it to you, and what was it?

Smith: I guess I was given two pieces of advice. General Stiner, the USCINCSOC at that time, hired me for this job. He expected me to execute the mission without any bureaucratic interference.

I was given another piece of advice by a congressional staff member. This lady explained to me why they had given these unique acquisition authorities to SOCOM. They wanted SOCOM to be one of the first acquisition organizations to streamline and field weapon systems on a fast-track schedule. The first program we could streamline was the MARK-V Special Operations Craft. Congress appropriated money in our budget to execute this program rapidly. We executed a very fast-track schedule; we saved about two to three years off the normal time it would have taken to get the boat into production.

Program Manager: The MARK-V Special Operations Craft — now there's another story in itself.

Smith: Yes. That's the model you saw in our outer office. During the developmental testing we had three

> **They [SOCOM PMs] don't have too much of a chance to determine whether they're going to take risks because we demand that they shorten all their acquisition schedules — and the user demands it. They have critical needs where they require the equipment fast. There's a mindset here, that if we're going to manage a program on the same schedule as one of the Services, we're not doing our job.**

competing contractors. We gave them six months from contract to deliver their prototype boats. We put them in a "boat-off" or "sail-off." One performed very well.

We then entered low-rate production, did more testing and modifications, and proceeded into full-rate production. From the time we initially released the RFP — going through competitive test, our down-select, and re-proposal effort for production — to award of the LRIP contract was 23 months. We then gave Halter Marine nine months to deliver the first full-up production article. They delivered.

We just signed a contract Monday [June 2, 1997] on a similar system called the Rigid Hull Inflatable Boat. It's a 36-foot-long boat. We gave the contractor five and a half months to deliver these craft. The competitors all delivered on time.

We again selected three competitors. One delivered a boat that was too heavy and was set aside, which generated a protest. We countered the protest. We then took the remaining two boats into competitive test and did a full operational evaluation; we just awarded the production contract last Monday to the winner.

Program Manager: Is there anything else that I haven't covered or any other area you'd like to talk about?

Smith: I'm glad you asked. I'm extremely proud of the SOCOM acquisition workforce. They all are very dedicated; they work very hard and try their best to get the user good, performing material. I'm just very proud of all the things that they do. And in this business, it's the people that really make acquisition streamlining work. They get all the credit.

Program Manager: Mr. Smith, you and your staff are doing a remarkable job, critical to our nation's defense and our special operations forces deployed worldwide — missions and programs for which you and your talented staff will never be sung heroes. We wish you continued success.

Smith: Thank you.

Naval Postgraduate School

A High-Quality, DoD-Relevant, Technology-Based Acquisition Education

CHIEF JOURNALIST AUSTIN S. MANSFIELD, U.S. NAVY

Housed in a landmark complex with a storied past, the Naval Postgraduate School (NPS) in Monterey, Calif., offers an extensive professional acquisition curriculum for military officers or Department of Defense (DoD) officials with an eye toward education and advancement in the professional acquisition workforce. Its education program, however, is not limited to acquisition. The school offers more than 40 courses, specifically structured for military systems and management, in a myriad of disciplines:

- Information Technology Systems
- Financial Management
- Aeronautics
- National Security
- Operations Research

Due to the fluxion of modern technology, the faculty and staff at the school constantly reassess the U. S. military's educational needs, ensuring students remain ahead of their contemporaries.

NPS is also one of 13 consortium schools in the Defense Acquisition University (DAU). Army Brig. Gen. Richard Black, Commandant of the Defense Systems Management College

DURING A MARCH 1997 FACT-FINDING TOUR OF SEVERAL DAU CONSORTIUM SCHOOLS, ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT, MADE AN ON-SITE VISIT TO THE NPS CAMPUS. FROM LEFT: NAVY CAPT. JOHN LANGAN, DEPUTY NAVY DACM; DAVID WHIPPLE, ASSOCIATE PROVOST FOR INNOVATION, NPS; DICK ELSTER, PROVOST, NPS; BLACK; DAVE LAMB, DIRECTOR OF SYSTEMS MANAGEMENT DEPARTMENT, NPS; DENNIS ALLION, DEPUTY DIRECTOR, CAETR, NPS; TONY KAUSAL, DSMC AIR FORCE CHAIR.
Photo by Richard Mattox

THE HOME OF THE NAVAL POSTGRADUATE SCHOOL IS THE HISTORIC HOTEL DEL M(RESORT COMPLEX ORIGINALLY BUILT IN 1880 BY RAILROAD MAGNATE CHARLES CR(WORLD. IN 1942, UNDER THE EXIGENCY OF WAR, THE NAVY REQUISITIONED THE H(FLIGHT TRAINING SCHOOL. IN 1947, THE 80TH CONGRESS AUTHORIZED AND APPF DEL MONTE HOTEL AND 627 ACRES OF SURROUNDING LAND TO PROVIDE A CAMP:
Photo by Richard Mattox
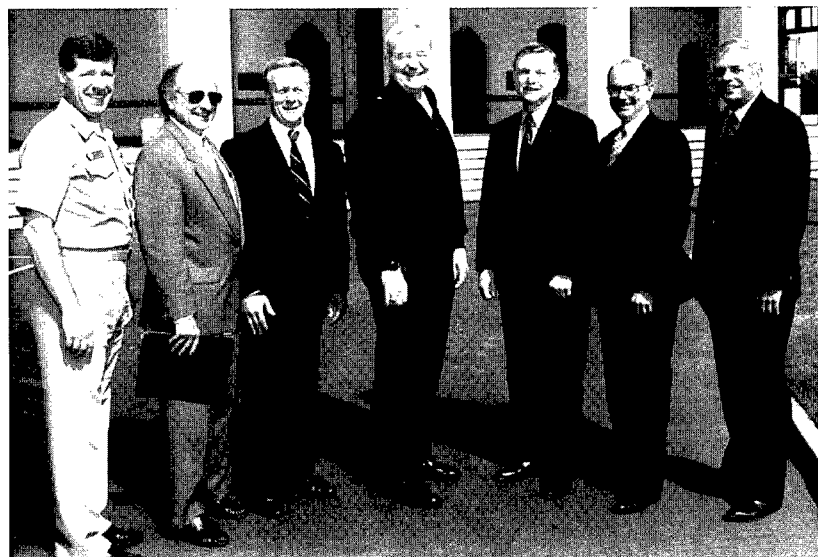
Mansfield is a U.S. Navy Chief Journalist and leading chief petty officer at Naval Postgraduate School, Public Affairs Office, Monterey, Calif. Throughout his career, he has served as a broadcaster, news director, and reporter on U.S.S. Camden; and in Panama, Sicily, Turkey, Northern Iraq, Somalia, and Bosnia-Herzegovina. He holds an M.S. in International Relations from Troy State University and graduated magna cum laude from the University of Maryland with a B.S. in Management Studies.

Photos by U.S. Navy Chief Journalist Austin S. Mansfield unless otherwise indicated.

" The school offers more than 40 courses, specifically structured for military systems and management, in a myriad of disciplines..."

(DSMC) visited NPS in March 1997 during a fact-finding tour of DAU schools and found that the "NPS resident program offers the acquisition workforce high-quality, DoD-relevant, technology-based graduate training that civilian institutions and many military schools can not duplicate."

The Program

DAU provides mandatory and specific courses for military members and civilians working in 11 career fields, training these professionals for effective service in the defense acquisition system. As a member of the DAU consortium of schools, NPS offers training in three of these career fields: acquisition logistics; systems planning, research, development and engineering; and test and evaluation. Training in these fields is a three-tiered system in which students' levels of study typically coincide with their levels of responsibility and position. The courses at each level correspond to various scopes and expertise in each career field.

- Level 1 (entry) courses cover fundamental knowledge, establishing basic qualification and expertise in the employee's

DENNIS ALLION, DEPUTY DIRECTOR OF THE CENTER FOR ACQUISITION, EDUCATION, TRAINING, AND RESEARCH (CAETR) AT THE NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.

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ER, THEN ONE OF THE RICHEST MEN IN THE
AND ESTABLISHED THE DEL MONTE PRE-
IATED $2.13 MILLION TO PURCHASE THE
OR NPS.

ROWENA GRIMES EXPLAINS SITE INSPECTION PROCEDURES TO STUDENTS IN THE EXECUTIVE ACQUISITION LOGISTICS MANAGEMENT COURSE AT THE HOLIDAY INN IN MONTEREY, CALIF.

DR. DAVID LAMM, DIRECTOR OF THE CENTER FOR ACQUISI-
TION, EDUCATION, TRAINING, AND RESEARCH (CAETR) AT
THE NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
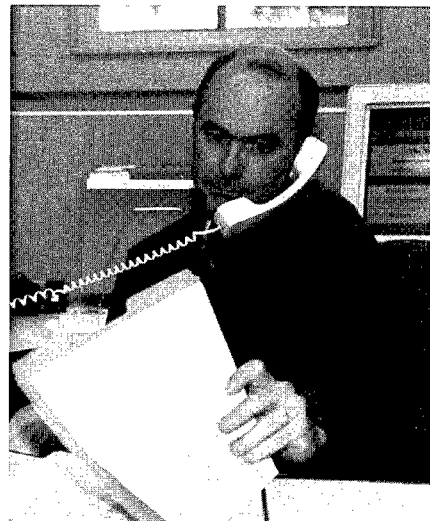
career field, job series, or functional area.

- Level II (journeyman) courses emphasize functional specialization, enhancing each student's capabilities in a primary specialty or functional area.

- Level III (manager) courses emphasize managing the acquisition process and learning the latest methods being implemented in the career field or functional area.

Offered in various modes, the most common method of instruction is resident, where a student attends class at the Naval Postgraduate School. On-site instruction is also available, where the instructor goes to a location that has enough students to support a class.

CAETR Established

Because acquisition is a complex process, and professional skills and attributes are essential for the people performing acquisition functions, in 1991 Congress passed the Defense Acquisition Workforce Improvement Act (DAWIA). DAWIA legislated certain levels of education, training, and experience requirements for critical acquisition positions.

In response to the DAWIA legislation, Dr. David Lamm, a retired U.S. Naval officer and NPS employee since 1978, created the Center for Acquisition, Education, Training, and Research (CAETR) at NPS in 1992, thus satisfying the requirements set forth in DAWIA. Headed by Lamm as its current director, the CAETR offers the DAU short courses:

- Executive Acquisition Logistics Management (LOG 304)

- Intermediate Systems Planning, Research, Development, and Engineering (SYS 201)

- Intermediate Test and Evaluation (TST 202)

- Advanced Test and Evaluation (TST 301)

"It's important to note," says Lamm, "that when we teach short courses to the acquisition workforce at Levels I, II, and III, they're not directed solely at the Navy and Marine Corps — they encompass four major groupings: Army, Navy/Marine Corps, Air Force, and what we commonly refer to as the fourth estate — agencies such as the Defense Logistics Agency, Defense Mapping Agency, Defense Security Assistance Agency, and Defense Communications Agency.

"All of these major agencies," Lamm continued, "comprise the fourth estate, and they have 20,000 to 25,000 acquisition billets. So Army, Navy/Marine Corps, Air Force, and fourth estate — that's where these 110,000 to 120,000 people come from. Of that total, only about 10 to 12 percent are military positions, so most are civilian students."

Innovation

Innovation is key in any learning environment, and CAETR integrates innovation into its curriculum as well as its day-to-day operation. According to Dennis Allion, CAETR's deputy director, "We try to be innovative in the way we present materials in the classrooms, in the way we use facilities. We don't have any classroom facilities dedicated to us on the campus, so we go out in town to negotiate with hotels to provide us classrooms."

Speaking of the professors on staff at CAETR, Allion commented, "When we need faculty to teach a course, we negotiate with departments for their time. We negotiate how much time we get, and how much money we will pay.

"The use of innovation," said Allion, "is largely constrained to using the tools that we have available to us. We

do things out on the Internet. We have not yet designed an Internet-based course, but we are working at that, and the Defense Acquisition University is very much into it. We don't have the human resources to do that now ourselves, but we are using the Internet. All of our course materials are available on the CAETR Home Page."

http://web.nps.navy.mil/~caetr/caetr.htm

Equivalencies

CAETR's director, Dr. David Lamm, speaks with enthusiasm and confidence in CAETR's ability to meet the education needs of the acquisition workforce. "DAWIA mandated that in the acquisition fields there will be qualifications for people. In other words, the whole law said, 'All these people who have been working in these fields haven't been as fully qualified as they should be, and so they need to be qualified.' The law established requirements in education, training, and experience."

Related to the Defense Acquisition Workforce, NPS offers a Master of Science in Management degree in two areas: Acquisition and Contract Management (815) and Systems Acquisition Management (816). However, these degree programs are not part of the DAWIA mandate, even though the curricula cover DAWIA-required material.

Lamm explains some of the problems students who lack equivalency may face. Without equivalency, a student "who went through contracting for example, did all the contracting courses at a graduate level, and went out to manage a contracting shop, could still be told, 'but you didn't have any of the mandatory training' — they had graduate education as opposed to the short course training." Equivalency, according to Lamm, says that "if you've done this graduate program in contracting, you've satisfied all of the short course requirements."

Speaking specifically of the 815 and 816 curricula, Lamm explained that "Anybody who has taken the 815 program (Acquisition and Contract Management) satisfies the equivalency for a whole variety of courses. And anybody who's got the 816 program, Systems Acquisition Management, has satisfied [other] equivalencies." Specifically, the 815 curriculum provides equivalence for DAU courses:

- Contracting Fundamentals
  (CON 101)

- Contract Pricing
  (CON 104)

- Government Contract Law
  (CON 201)

- Intermediate Contracting
  (CON 211)

- Intermediate Contract
  Administration
  (CON 221)

- Intermediate Contract Pricing
  (CON 231)

- Executive Contracting
  (CON 301)

- Systems Acquisition for
  Contracting Personnel
  (PMT 341)

The 816 curriculum provides equivalence for —

- Fundamentals of Systems
  Acquisition Management
  (ACQ 101)

- Intermediate
  Systems Acquisition
  (ACQ 201)

- Advanced
  Program Management
  (PMT 302)

- Intermediate Systems
  Planning, Research, Development, and Engineering
  (SYS 201)

An NPS student in the appropriate degree field receives equivalent credit for the applicable mandatory DAU courses. Therefore, acquisition workforce members taking a degree program at NPS can earn Level III certification as part of their studies.
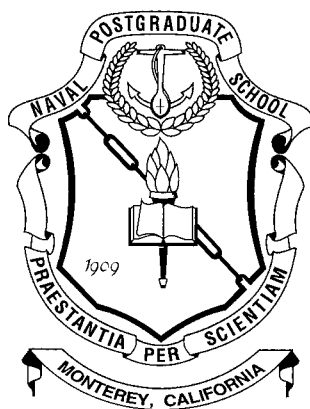
"Four or five years ago, these courses would not have been as available for these students," according to Dennis Allion, CAETR's deputy director. "A lot of civilians would not have been attending these courses; a lot of these courses didn't exist."

- Intermediate Test
  and Evaluation
  (TST 202)

- Advanced Test and Evaluation
  (TST 301)

Offerings in the near future include —

- Production/Quality
  Management Fundamentals
  (PQM 101)

- Intermediate Production/
  Quality Management
  (PQM 201)

- Basic Software
  Acquisition Management
  (SAM 101)

- Intermediate Software
  Acquisition Management
  (SAM 201)

What this means is that the redundancies of forcing employees to "re-learn" subjects in which they're already proficient, merely to check off a list of requirements, has been superseded by logic. An NPS student in the appropriate degree field receives equivalent credit for the applicable mandatory DAU courses. Therefore, acquisition workforce members taking a degree program at NPS can earn Level III certification as part of their studies.

"Four or five years ago, these courses would not have been as available for these students," according to Dennis Allion, CAETR's deputy director. "A lot of civilians would not have been attending these courses; a lot of these courses didn't exist."

"With the whole downsizing of the Department of Defense and the shrinking defense budget," he continued, "there's been an emphasis on change in the way that acquisition is done. It's putting more emphasis on the contractor and less on the Department of Defense to design, administer, and develop weapons systems."

The effects of this technique are far-reaching. "Hopefully the taxpayers benefit," said Allion. "The idea is by having people who are better educated and better trained, that they'll do a better job and help keep costs down. We're talking about billions of dollars, every year, spent on acquiring things. That's big bucks. The other persons that benefit are the warfighters themselves, because they've got the equipment that they need, it's reliable, and will do what it was designed to do. And that helps us keep the peace."

Inquiries concerning DAU course offerings at NPS should be directed to —

CAETR Support Staff
Systems Management Department
Naval Postgraduate School
(Code SM/Hk)
555 Dyer Road, Rm 229
Monterey, Calif. 93943-5103

Comm: (408) 656-3578/3579/
           3580/3613
DSN: 878-3578/3579/3580
Fax: (408) 656-3409
or   DSN 878-3409
ATRRS Mail ID: HICKSE
Website: http://vislabwww.nps.mil/
           ~caetr/caetr.html

Direct all other inquiries to —

Dennis Allion, Deputy Director,
CAETR, & Lecturer,
Systems Management Department
Naval Postgraduate School
(Code SM/A1)
555 Dyer Road, Rm 229
Monterey, Calif. 93943-5103

E-mail: dallion@nps.navy.mil

Dr. David Lamm, Director
CAETR, & Professor, Systems
Management Department
Naval Postgraduate School
(Code SM/A1)
555 Dyer Road, Rm 229
Monterey, Calif. 93943-5103

E-mail: dlamm@nps.navy.mil
ATRRS School Code: 770

REAR ADM. MARSHA JOHNSON EVANS

U.S. Navy
Superintendent
Naval Postgraduate School

A native of Springfield, Illinois, Rear Adm. Marsha Johnson Evans graduated with high honors from Occidental College in June 1968. Two months later, she was commissioned an ensign at Women's Officer School, Newport, Rhode Island. Early assignments included duty with the Defense Intelligence Agency; Office of the Commander, Fleet Air Western Pacific staff, Atsugi, Japan; and Office of the Chief of Naval Operations (OP-04). In 1973, she became the first woman Surface Assignments Officer in the Bureau of Naval Personnel. Concurrently, she served as Senior Navy Social Aide to the President of the United States.

Following selection as a Chief of Naval Operations Scholar in 1975, Evans earned a master's degree in law and diplomacy at the Fletcher School of Law and Diplomacy, Tufts University. Subsequently she served as the Middle East Policy Officer on the staff of the Commander in Chief, U.S. Naval Forces Europe. Selected as a White House Fellow in 1979, she served a one-year fellowship as Executive Secretary and Special Assistant to the Secretary of the Treasury. In early 1981, she became the Deputy Director of the President's Commission on White House Fellowships.

In 1982, Evans was assigned as Executive Officer, Recruit Training Command, San Diego, and from 1984 to 1986 as Commanding Officer, Naval Technical Training Center, Treasure Island, San Francisco. She served the next two years as a Battalion Officer at the U.S. Naval Academy. During that assignment, she also chaired the Women Midshipmen Study Group, served on the Navy's 1987 Women's Study, and taught classes in international relations.

In 1989, Evans began a one-year assignment as Chief of Staff, Naval Base San Francisco. On June 15, 1990, she assumed command of Naval Station Treasure Island, San Francisco. In November 1991, she returned to the Naval Academy as Chief of Staff, an assignment that was curtailed in August 1992 when she became the Executive Director of the Standing Committee on Military and Civilian Women in the Department of the Navy. From June 1993 to July 1995, Evans served as the Commander of the Navy Recruiting Command. She assumed her current duties on September 8, 1995. While Superintendent of the Naval Postgraduate School, she has also served for seven months as the interim director of the George C. Marshall European Center for Security Studies in Garmisch, Germany.

Evans is a graduate of the Naval War College off-campus program and a 1989 graduate of the National War College. She is married to Gerard R. Evans of Pensacola, Fla.

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SECDEF Speaks at NDU Joint Operations Symposium — QDR Conference

Fort McNair, Washington, D.C. • June 23, 1997
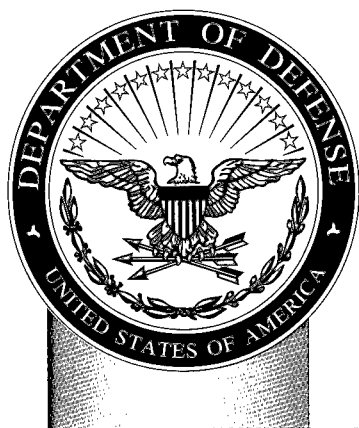
Editor's Note: The following text presents Secretary of Defense William S. Cohen's remarks at the National Defense University (NDU) Joint Operations Symposium — QDR Conference. Cohen's speech focused on what he calls an ongoing and future "Revolution in Military Affairs" or RMA, which he believes must be accompanied by a "Revolution in the Business Affairs" of DoD. *Program Manager* is pleased to publish his remarks in their entirety.

The past two weeks Shakespeare's *Henry V* has been playing at the Carter Barron Amphitheater here in Washington. The play depicts one of the most famous battles in military history. It is the Battle of Agincourt, where some 6,000 English common soldiers defeated a French army of armored noble knights at least four times in size.

With imaginative leadership and tactics, the English enticed the French into a frontal attack. As the slow-moving knights waded through ankle-deep mud in their heavy armor, they were cut down by English longbow archers on their flanks. By the time their depleted numbers reached the English lines, they were easy victims to English yeoman using axes and swords.

It was a crushing blow to the age of the armored knight and feudal warfare. It was one of a series of battles in that era that signaled a revolution in the way armies fought, maneuvered, and organized themselves.

Revolution in Military Affairs

I felt the early rumblings of another revolution in military affairs in March, when I went out to Fort Irwin in California to see the Army's Force XXI experiments, applying digital technology to modern land warfare. I saw soldiers with satellite navigation sets in their backpacks; and M-16s in their hands equipped with thermal sensors, laser rangefinders and image-intensifiers. They drove Humvees with computer screens bolted to the dashboards showing troop locations across an area the size of Rhode Island. And they were linked to their commanders and war planners with a kind of battlefield Internet that gave them all a clear, common, real-time picture of the battlefield, vastly reducing the fog of war.

It was clear to me that just as the longbow, the pike, and gunpowder eventually forced the armored knight from the field, so are we now witnessing the triumph of the microchip in warfare, transforming it in ways we are only beginning to comprehend.

I sensed an urgency: an urgency to get this technology into the force; to experiment with it so we understand its implications; and to develop the operational concepts, doctrine, and tactics to take full advantage of it.

I also recognized the reality that it is going to be difficult to seize that future I saw at Ft. Irwin, while at the same time sustaining our present forces, missions, and military superiority. That was the great contribution of the Quadrennial Defense Review: to give us a realistic plan to reach this visionary goal, not only to modernize the force – which implies **evolutionary** change – but also to foment **revolutionary** change to take our forces well into the future.

Twenty years ago, Alvin Toffler warned that, "unless you tame technology, you will encounter future shock." We want to harness technology for defense so that it is our enemies who suffer "future shock," while we gain "future security." To do so, we must take specific steps to harness the Revolution in Military Affairs and begin to build the future force today.

Joint Vision 2010

Out to the mid-term future, the initial template for our future force will be "Joint Vision 2010." It is built on an integrated "system of systems" that aims to give our forces total battlespace awareness, as well as the capability to maneuver and engage the enemy at the times and places of our choosing throughout the entire battlespace. This system of systems will integrate the laptop, the microchip, the microwave, the videocam, the satellite,

and the sensor. It will connect the cockpit, the quarterdeck, the control panel, and the command post; and link the shooter, to the commander, to the supplier.

It will aim to collect and distribute a steady flow of information to U.S. forces throughout the battlespace, while denying the enemy the ability to do the same.

- With a full picture of the battle-space, advanced weapons, and agile organizations, U.S. forces will be able to attack enemy weak points throughout the depth and breadth of the battle-field — summed up by the phrase *dominant maneuver.*

- They will also have *precision engagement* — the ability to pre-cisely deliver the desired effects at the right time and place on any target.

- They will be supported by *focused logistics* — the ability to deliver the right supplies at the right time and place on the battlefield.

- And they will have *full dimen-sion* protection — multiple lay-ers of protection against a full spectrum of threats, from ballis-tic missiles to germ warfare, giv-ing them greater freedom of action in all phases of combat.

What these four capabilities mean is that our forces will deploy lighter. They will need fewer weapons plat-forms and fewer munitions. They will be able to direct both lethal and non-lethal fire to the right targets. There will be less collateral damage, less friendly fire, and fewer U.S. and allied casualties. U.S. forces will be able to descend on the scene early in a con-flict, take the initiative away from a numerically superior foe — getting inside his decision cycle — and end the battle quickly on our terms.

These capabilities are not drawn from the "X-Files" or the Starship Enter-

...we [are] now witnessing the triumph of the microchip in warfare, transforming it in ways we are only beginning to comprehend.

prise. Right now, soldiers, sailors, air-men and Marines are conducting research, experiments, and exercises to make them a reality. It's not just the Army and Force XXI. It's also Air Force Battle Labs exploring opera-tional concepts in cyberspace and outer space. And it's the Navy and Marine's Fleet Battle and Sea Dragon Experiments.

This year at 29 Palms and Camp Pendleton, the Marines conducted the Hunter Warrior Experiment. It showed us how lightly armed units can dominate large coastal regions, not by landing on the beaches, but by leaping over them in V-22s, spreading out and operating deep inside enemy territory. They used hand-held Apple Newton computers to send out hard-to-detect digital bursts to call in long-range, precision firepower from ships, choppers, fighters, and other military assets.

The Navy, meanwhile, was offshore holding Fleet Battle Experiment Alpha. They looked at how to provide fire support to the Hunter Warrior teams from carriers, surface combatant ships, and even arsenal ships. Overall, the experiments showed that such a force may be able to not only prevail against a much heavier, numerically superior enemy force — but to domi-nate it. In fact, one of the Marines' alternate titles for Hunter Warrior is "Agincourt Update."

The Navy is also starting to link its ships together with a system called Cooperative Engagement Capability — CEC. CEC gives all battle group ele-ments a common, tactical, real-time picture of the battlespace. When an enemy aircraft or missile threatens any one of them, they all see it and track it in real-time. Then, whoever is in the best position can knock it out of the sky while others can hold their fire. It also allows ships to operate in spread-out formations, presenting a more dif-ficult target.

CEC is part of a move to what the Joint Staff calls "network-centric" warfare, and it is not pie-in-the-sky. Last week, in Bahrain, I was aboard the U.S.S. *Fitzgerald,* an Aegis destroyer that has been conducting exercises to prepare for the fielding of CEC capabilities.

These experiments and technologies are pointing the way to a force that in the mid-term — five to 10 years from now — will have much greater capabil-ities. And this has important implica-tions for our force structure. Heavy army divisions are going to be leaner. Carrier battle groups are going to be smaller. As the Air Force acquires bet-ter, more capable platforms, our tacti-cal fighter force structure can be reduced.

These are not merely ideas. I am already making decisions based upon the Services' plans to adjust force structure as the forces' capabilities grow. Earlier this month, I approved the Army off-site plan, which proposed

restructuring that will markedly reduce men and equipment in some Guard divisions as they acquire greater capabilities. And during the QDR, the CNO proposed – and I accepted – his plans to reduce the number of ships in battle groups to reflect the enhanced capabilities being introduced into the fleet.

Pursuing the Revolution

But this is only a glimpse into the future. Today's experiments, technologies, and concepts are not the culmination of the Revolution in Military Affairs, but the beginning. They are the gathering of the pitchforks, Thomas Paine sharpening his pen, and the early rumblings of a revolution that will bring us a true transformation in long-term capability 15 to 25 years from now.

The Army is already developing a vision for the Army After Next through a series of wargames going on at Carlisle. They are looking at a leaner, more versatile, lethal, and deployable force that will be able to operate so fast and so far inside enemy lines that the term "front line" will become an anachronism.

Starting in September, the Marines will begin a series of experiments to understand how to fight in future urban coastal regions – where 75 percent of the world's people will live by the year 2020. They are looking at: What kind of information architecture does the dense urban battlefield require? What kind of *nonlethal* capability will we need? And how can we develop an advanced, forward sea-basing capability so we do not have to fight for beaches just to move a mountain of supplies ashore?

The Air Force is committed to reshaping itself from an Air Force to an Air and Space Force and – someday – to a Space and Air Force. The Air Force is also talking about adding a third version of the Joint Strike Fighter. The conventional and vertical take-off versions are already on the drawing board. The third version would be

The technology, weapon, or doctrine that looks like the sure-fire path to the future today may be over-taken and obsolete in five, 10, or 15 years...

unmanned – taking us into an entirely new era of air warfare.

What we must keep in mind is that we do not and cannot know the end-state of this revolution, or even the course the revolution will follow. During the French Revolution, at height of the Terror, as Danton was being carted off to the guillotine, he shouted out, "You will follow us, Robespierre!" Inside of three months, he was proved right. But Robespierre was oblivious to the direction of events.

As architects of our own revolution, we have to reach out to the future with open eyes and open minds – daring to experiment and ready to switch courses based on what we discover. The technology, weapon, or doctrine that looks like the sure-fire path to the future today may be overtaken and obsolete in five, 10, or 15 years as the revolution unfolds. This also argues for a focused modernization plan that provides us the flexibility to pursue different paths in the future rather than committing too far, too early – leaping before we look.

The second important thing to keep in mind as we pursue this revolution is

that history shows that most critical aspect of profound military innovation is not technology, but understanding what we can do with it. The primary, important military technologies are increasingly widely available. The key to success is developing innovative operational concepts, doctrine, and organizations that can best exploit these technologies.

Look back at the 1920s and '30s – a period of fertile military innovation and experimentation that dictated the eventual course of World War II.

The British and the French knew how to make a good tank. But it was the Germans who blitzkrieg'd across Europe using the concept of combined arms maneuver, putting together the latest capabilities of tanks, aircraft, radios, infantry, and logistics.

Britain's fighter air defenses – which bested the numerically superior Luftwaffe in 1940 – relied on radar, but they relied even more on advanced communications and centralized command and control.

And in the Pacific, the United States leapt ahead in developing amphibious and carrier-based warfare, not so much because of the quality of our ships, but because we understood how to use them, how to move soldiers and Marines ashore, how to put more planes on decks, and how to increase sortie rates.

All of these eventual outcomes were the product of warfighting experiments in the 1920s and '30s.

This historical analogy underscores not only the importance of doctrine, but also the importance of guarding against complacency. We must not, in our hubris, assume that we will be the sole vanguards of the new Revolution in Military Affairs.

Periods of revolution are inherently unstable, allowing unsuspected actors – even relatively small powers – to

come in and hijack the revolution for their own ends if they make the right choices. It is important to remember that in 1941 Japan's GNP was only about 10 percent of the United States', but Japan did almost as well as the United States in developing concepts of carrier aviation, and held us to a stand-off in the Pacific for over two years.

Exploiting the Revolution

If we are to exploit the Revolution in Military Affairs, we too have to make the right choices. The first choice we have to make is how to balance our present needs with our need to build for the future. The QDR looked at three different options in this regard.

- The first option was to focus on current dangers. Under this option we would maintain the current force structure, exercise it at a high rate, and repeatedly delay the increase in procurement spending that will allow us to exploit the RMA [Revolution in Military Affairs]. This was essentially business as usual, and the QDR rejected business as usual.

- The second option was to seek to rapidly and radically restructure the force for the future. You could call this the Jacobin option, where we say "off with their heads," making dramatic cuts to the force to pay for a more aggressive pursuit of the revolution. This was surely the boldest course, but, I am convinced, not the best. Not only would it have seriously constrained our ability to shape the security environment by reducing our force presence overseas, but it would put our troops at greater risk in the near- and mid-term.

Moreover, it is not even clear that this option was the best path to realizing the RMA. We need the intellectual firepower of our officers and senior enlisted corps to develop the operational concepts and doctrine that will make the RMA a reality. If we gut today's force, we are going to have a hard time keeping that intellectual firepower in uniform.

And we would end up making premature decisions about technologies, operational concepts, and force structure before we have in hand the necessary information from our warfighting experiments, leading us to pour vast sums into conceptual cul-de-sacs.

- The option we chose — option three — strikes the necessary balance between the needs and risks of today, with those of the future.

It pays for a focused modernization plan to deploy advanced systems at the right pace, accelerating some new programs and slowing down others, depending on how mature the technology is. And we have reduced the size of some programs, because their advanced capabilities mean that fewer are needed. This focused plan also gives us the time to conduct our warfighting experiments the right way, which recognizes that success depends upon the freedom to fail; to test out many revolutionary concepts knowing that some will be a bust while others will succeed.

Paying for the Revolution

To pay for this modernization, we made modest reductions in force structure, focused on the tail, not the tooth. This will enable us to continue to meet current threats and shape the security environment at an historical moment of great flux.

We also reached a central conclusion of the review: that the only way to pay for a continuing Revolution in Military Affairs was to also have a "Revolution in the Business Affairs" of DoD to slough off the excess weight we still carry from the long winter of the Cold War.

We need to be like a decathlon athlete — fast, agile, and able to do many things well. And if we continue to carry around our excess weight, we will not be able to jump as high nor run as fast or as far as we must. That is why we have gone to Congress to ask for two more rounds of BRAC and the ability to outsource more depot maintenance work. And that is why I have appointed a Defense Reform Task Force, which will be overseen by DoD Comptroller John Hamre, to advise me on further ways we can restructure, consolidate, and reengineer the Department.

Taking the Right Road

The end result is a plan that will take us safely from the present to the future.

It will allow us to exploit the Revolution in Military Affairs in a focused, balanced, and realistic way. It will buy us the new hardware and capabilities we need to maintain our military superiority for the near- and mid-term. But it also takes us out beyond the mid-term, where the true revolution lies.

It challenges our best minds to look beyond the horizon to imagine new ways of doing things. It challenges our Department to slim down and shape up. And it challenges our nation to move seamlessly from being the dominant power in one era and one century, to being the dominant power in a new era and a new century.

History has given us the choice; science has given us the chance; love of country gives us the duty — to reach out to this future and pull it toward us. Now we must summon the courage to let go of the past. For as Dag Hammarskjold said: "Only he who keeps his eye fixed on the far horizon will find his right road."

1997 Acquisition Research Symposium — Report And Highlights

BERYL A. HARMAN

On 24 June 1997, the Acquisition Research Symposium, sponsored by the Deputy Under Secretary of Defense for Acquisition Reform, welcomed over 250 acquisition workforce professionals representing a mix of industry, Department of Defense (DoD), other federal agencies, and representatives from academia interested in understanding the status of acquisition reform and working toward the future. Co-hosted by the Defense Systems Management College

FROM LEFT: CALVIN BROWN, DSMC SYMPOSIUM CO-CHAIR; JONATHON ETHERTON, PROFESSIONAL STAFF, SENATE ARMED SERVICES SUBCOMMITTEE ON ACQUISITION AND TECHNOLOGY, AND ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT.

PANELISTS, CIVILIAN AGENCY ACQUISITION EXECUTIVES, "INNOVATION OUTSIDE OF DOD" — THURSDAY, JUNE 26. FROM LEFT: IDA M. USTAD, DEPUTY ASSOCIATE ADMINISTRATOR FOR ACQUISITION POLICY, GSA; DAVID A. DRABKIN, ADUSD (ACQUISITION PROCESS AND POLICIES); DENNIS M. DEGAETANO, DEPUTY ASSOCIATE ADMINISTRATOR, OFFICE OF RESEARCH AND ACQUISITION (ARA), FAA; AND DIERDRE A. LEE, CO-CHAIR, NCMA, PANEL MODERATOR, AND ASSOCIATE ADMINISTRATOR FOR PROCUREMENT, NASA.

BRUCE S. POTOCKI RECEIVING THE "DAVID D. ACKER AWARD FOR SKILL IN COMMUNICATION" FROM ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT.

RICHARD SYLVESTER, DIRECTOR OF ACQUISITION IMPROVEMENT PROGRAMS, ASSISTANT DEPUTY UNDER SECRETARY OF DEFENSE FOR ACQUISITION REFORM — LUNCHEON SPEAKER, WEDNESDAY, JUNE 25.

Harman is a Professor of Acquisition Research in the Research, Consulting, and Information Division, DSMC. On behalf of the Acting Deputy Under Secretary of Defense for Acquisition Reform, DSMC congratulates the Symposium co-Chairs, William Birkhofer, NCMA, Joan Sable, DSMC, and Calvin Brown, DSMC; the Symposium Committee Members; and all other volunteers who made the Symposium a resounding success.

Navy Cmdr. N.D. Pisano, receiving the "David D. Acker Award for Skill in Communication" from William J. Birkhofer, NCMA Symposium Co-Chair — Wednesday, June 25.

Joan L. Sable, DSMC Program Co-Chair — Administrative Announcements, Friday, June 27. ►

Guest speaker John J. Hamre, Under Secretary of Defense (Comptroller), Chief Financial Officer, DoD, and Deputy Secretary of Defense nominee — Wednesday, June 25. ▼

From left: William J. Birkhofer, NCMA Symposium Co-Chair; Mary Ann Gilleece, NCMA Program Co-Chair; Stephen K. Conver, Vice President, Business and Development, Lockheed Martin Corporation; and Calvin Brown, DSMC Symposium Co-Chair.

Symposium Presenters. ▼

John F. Phillips, Deputy Under Secretary of Defense (Logistics) — Guest Speaker, Friday, June 27.

NORMAN R. AUGUSTINE, CHAIRMAN AND
CHIEF EXECUTIVE OFFICER, LOCKHEED
MARTIN CORPORATION — KEYNOTE
ADDRESS, WEDNESDAY, JUNE 25.

(DSMC) and the Washington, D.C., Chapter of the National Contract Management Association (NCMA), the two organizations organized the 1997 Symposium around the theme, "Acquisition for the Future: Imagination, Innovation, and Implementation."

Sustaining Acquisition Reform

This year's Symposium focused on exploring how acquisition reform can be sustained, recognizing all of the challenges resulting from implementation of the National Performance Review of 1993; and passage of the Government Performance and Results Act of 1993, the Federal Acquisition Streamlining Act of 1994, the Federal Acquisition Reform Act of 1995, and the Clinger-Cohen Act of 1995. These laws and policies, coupled with the downsizing of the Federal Government, declining budgets, the thrust toward performance, and using good business sense, brought about significant changes in the attitudes of the professional acquisition workforce and how they manage DoD's acquisition program and processes. Recognizing these issues, the Symposium challenged presenters to share research, innovations, and implementation activities at sustaining the momentum of the acquisition reform effort.

Welcoming Remarks

William J. Birkhofer III, incoming President of the NCMA Washington Chapter, Vice President of Sverdrup Corporation, and Conference Chair opened the Symposium and welcomed the conferees. Birkhofer acknowledged the changes wrought by acquisition reform over the last four years and expressed his hope that reform will continue. In his view, sustaining acquisition reform momentum and institutionalizing acquisition reform activities are the challenges

ACQUISITION RESEARCH SYMPOSIUM

Defining the acquisition process as "scientific ideas transformed into the security of the nation," Augustine delivered what he termed, the "State of the Union Address of the Acquisition Process," explaining that it was useful to talk of evolution and what we have learned.

facing the acquisition workforce of the future. Yet, while great strides are evident, significant issues still remain that need to be assessed. Everyone in acquisition, both government and industry, needs to keep moving forward.

Following Birkhofer and continuing the conference theme, John J. Hamre, Under Secretary (Comptroller), Chief Financial Officer of the Department of Defense, and nominee for Deputy Secretary of Defense, addressed upcoming changes in the Office of the Under Secretary of Defense for Acquisition and Technology (USD[A&T]). Pointing out that Dr. Paul G. Kaminski, the former USD(A&T), had left good markers, Hamre expressed the view that he was confident acquisition reform would continue under the leadership of Kaminski's successor.

Recognizing the receptiveness of industry to acquisition reform, Hamre felt that the challenges ahead are in the area of technology utilization. While technology is available to institute good, new business practices, it is also a curse because of the existing legacy systems. This is why Secretary of Defense Cohen's personal agenda is to leverage technology and to redo business practices in the Department.

Hamre announced that the Secretary of Defense asked him to head up an effort aimed at reengineering DoD business practices. This activity will be a collage of techniques. Creating a paper-free environment for contracting; democratizing the acquisition process by establishing omnibus contracts for multiple purchases, using a Purchase Card rather than a separate finance activity; reengineering the source acceptance process to allow acceptance through a signed Purchase Card payment, rather than a DD Form 250 practice; and reengineering other policies and procedures are just a few. He concluded that the next 30 months will be very challenging for the Department of Defense.

Keynote Speaker

Following Hamre, Norman R. Augustine, Chairman and Chief Executive Officer, Lockheed Martin Corporation, and author of *Augustine's Laws*, delivered the keynote address. Defining the acquisition process as "scientific ideas transformed into the security of the nation," Augustine delivered what he termed, the "State of the Union Address of the Acquisition Process," explaining that it was useful to talk of evolution and what we have learned. Having chased, "the most perfect defense systems" most of his life, Augustine claimed that, "Historically, life has to be understood backwards in order to look forward." Based on this approach, he identified a Prehistoric Period of Acquisition followed by seven phases of acquisition evolution, but noted that all phases had things that were good and bad, and there was no intent to correlate them with anything in particular.

Prehistoric Period of Acquisition

He began with his interpretation of the *Prehistoric Period of Acquisition*. This began with the Continental Congress and its efforts in procuring ships. These acquisitions resulted in large overruns and the purchase of only a few of the items that were originally anticipated. This period lasted until the beginning of the 20th Century where acquisition, as we know it, really began.

Stone Age

The first phase of acquisition took place between 1903 and 1939 and takes us from the Wright Brothers up to World War II. Augustine labeled this phase the *Stone Age*. Life in acquisition was fairly simple and characterized by a one-page proposal, two-day evaluation, two-page contract, and multiple bidders. Contractors were noted for being entrepreneurs and risk takers.

Age of Plenty

The second phase, lasting from 1940-1960, is labeled the *Age of Plenty*, and in Augustine's mind, is characterized by the phrase, "just do it." Cost was not a major issue, and contracts were usually cost-reimbursable. There was a great deal of flexibility due to the policies of President Eisenhower. Time from contract award to first flight lasted on average about 10 months, and production was a 24-hour process with a new aircraft every 10 minutes. However, storm clouds were on the horizon because of increases in oversight. Average cost overruns, adjusted for inflation and quantity, were as much as 100 percent by the end of the war.

McNamara Era

The third phase took place between 1960 and 1967; this phase he termed the *McNamara Era*. DoD took its first major steps toward placing acquisition on a firm business footing, and problems were on the ascendancy. The focus was on paper and analysis, which in Augustine's view, was a partial mistake. During this time frame, DoD emphasized the consideration of options, adopted the first five-year plan, and initiated the concept of total package procurement (TPL). Adopting TPL, in Augustine's opinion, was a big mistake because it caused a lot of wasted procurement. Ultimately, however, TPL reduced overruns by an average 60 percent.

Age of Enlightenment

Phase four occurred between 1968 and 1979. This phase Augustine termed the *Age of Enlightenment*. America won the war in the Persian Gulf, and technology was on the ascendancy. Under David Packard's influence, acquisition went from analysis to prototyping, with cost reimbursement for research and development, and fixed price for production efforts. Although it was difficult to obtain Service recognition of the need, DoD initiated face-to-face decision making through the Defense Systems Acquisition Research Council (DSARC), and program managers, for the first time, were required to have unique skills. At the same time, David Packard founded the DSMC and instituted career progression education for program managers. DoD adopted award fee performance incentives, reducing average cost overruns to 35 percent. However, it now took 36 months from acquisition approval to contract award, and Congress usurped much of the acquisition power from the administration. Congressional staffs became increasingly important.

Dark Ages

Phase five, between 1979-and 1989, Augustine termed the *Dark Ages*. These were the Reagan years. Budgets increased rapidly. Coffee pots, hammers, and toilet seats became major acquisition issues, and there was a major increase in internal audits aimed at protecting government interests. As such, contractor overheads increased; "fraud, waste, and abuse" and "adversarialism" became the buzz words of the era as auditors gained independence and power. Program managers resorted to fixed price contracts for development efforts, and DoD instituted new conflict-of-interest rules regarding the movement of people going back and forth from government to industry. Congressional staffers moved to the Pentagon, but this did not create the closer ties with Congress that had been originally contemplated. The length of time to field a system rose to approximately 42 months, and program managers reduced cost overruns to 30 percent.

Decline and Rise of Empire

Phase six, Augustine termed the *Decline and Rise of Empire*. This period occurs between 1989 and 1999 and is essentially ongoing. In this time frame, DoD is faced with modernization and change. The collapse of the Cold War, industry downsizing, companies going out of business, price loss from reductions in competition, and refinement of the acquisition process have all instituted major challenges. It is an era characterized by streamlining, privatization, past performance evaluations, cost/performance trades, cost plus development contracts, terminations for lack of funds, protests due to desperation, debriefing changes, and complexity. It is now a 50-month effort to field a system, and develop-

ment efforts have virtually ceased. Augustine went on to add a caution about downsizing. His concern is that the administration will take downsizing too far.

Age of Reason
The last phase, phase seven, from the year 2000 and forward, he termed the *Age of Reason* or, as he put it, "Continue to do the right things; trust common sense and reason." He then offered some suggestions and recommendations concerning future acquisition activities:

- Use milestone budgeting to assist the budgeting process.

- Be willing to take risks. Do not hang risktakers. Hedge risks through the use of prototyping.

- Place greater emphasis on controlling costs.

- Appropriately share risk between seller and buyer through the use of the appropriate contract type.

- Provide reserves in people and technology to avoid future problems.

- Assign responsibility and accountability to the appropriate people and then leave them alone to do their jobs.

- Provide courageous management. Program managers should be willing to lay their careers on the line.

- Enact responsible collegialism versus adversarialism.

- Place greater emphasis on past performance, but at the same time do not dump good people for making mistakes.

Augustine concluded that DoD needs to balance military force modernization with force structure, and acquisition regulations need to be refined to represent the needs of the workforce, not to be an end unto themselves.

During a short question-and-answer session following his speech, Augustine offered the following thoughts and ideas:

- Use competition judiciously. Have competition when there is a need for new programs and when contractors have exhibited poor performance. Competition should be used as a tool and not something to check off in a box.

- His greatest accomplishment in the past few years has been working with Lockheed Martin to merge 17 individual companies into one.

- It is now very difficult for people to serve our government due to "revolving door" policies. It will be difficult to attract the necessary talent to fill government needs.

- The Government Performance and Results Act will have an impact on public service in the future. The idea is admirable, but the wrong measures will bring about the wrong performance.

Industry Perspective on Acquisition Reform
Following Augustine, Mary Ann Gilleece, a Partner of Manatt, Phelps and Phillips, Attorneys at Law, introduced and moderated a group of industry panelists to provide a roundtable discussion of "Industry's Perspective on Acquisition Reform: Where are We Now, and Where Do We Go From Here?"

Panelists included Donna Ireton, Director of Contracts, Advanced Systems Development; Dr. William Kimzey, Senior Vice President, Sverdrup Corporation; David B. Monaghan, Jr., Vice President, Finance and Planning, GTE; and Rhonda S. Summers, Manager, Government Contracts Compliance, Allied Signal Aerospace Equipment Systems.

Donna Ireton
Ireton centered her remarks on the

problems facing small business and what they should do. She expressed the view that the acquisition workforce (AWF), which includes both government and industry, are the drivers of acquisition reform. The AWF is responsible for the pressures it faces, but also has the means to create a balance. However, in her opinion there is considerable reluctance to follow through on the acquisition reform initiatives, e.g., to use commercial items and commercial services to satisfy government requirements.

In addition, industry is reluctant to raise the flag and admit they are commercial activities; i.e., to accept the risk of moving from cost plus to fixed price-type contracts. Where do we want to go; what is the correct attitude; how do we succeed? Ireton provided the following suggestions for small business owners:

- Decide whether the obstacles are worth it.

- Market differently.

- Monitor performance evaluations on a daily basis.

- Become proactive in meeting with government employees.

- Become electronically capable in monitoring, searching, and downloading solicitations from the Internet.

Teaming and partnering will aid in their survival. In other words they will need to *adapt*.

Dr. William Kimzey
Kimzey centered his remarks on the use of award fee and performance contracting. In his opinion, there is a difference in the way things are looked at within industry and government. Award fee is very seriously viewed by senior management in a company, while government workers only hear about the point scores. Contractors recognize that award fee scores promote pride and are important to the

success of the program. Performance contracting on the other hand, can hold back good ideas if done incorrectly.

It is important under this scenario for government to say *when* and allow industry to say *how*. This creates an environment for partnering. The barriers of micro-management — detailed "how tos" and lack of understanding — need to be removed. Progress through partnering will ensure that no laws or regulations are broken, and innovation can take place. The thing to remember is that a contract is only the framework for success. Getting things done is also necessary.

David B. Monaghan

Monaghan focused his comments on the implementation of acquisition reform. In his opinion, acquisition reform is very positive and is doing well. Citing the changes from cost plus contracting to fixed price; from Mil-Q-9848 quality compliance to ISO 9000 certification and management; from developing products to taking advantage of the commercial world; and that the Federal Acquisition Streamlining Act and the Clinger-Cohen Act are facilitating better interaction between buyers and sellers, Monaghan felt that acquisition is moving forward. However, aggressive implementation and business process reengineering is still needed. Today's different environment requires a reduction in control. On the surface new requirements are being adhered to, but beneath the surface the old processes are still being practiced.

Change needs to be *revolutionary*, not *evolutionary*. Business, in addition, needs to be proactive. There needs to be a repeal of the statutory limits on fees and profits. Buy American, fly American. Executive compensation rates and administration make little sense in a competitive market. There needs to be a focus on reasonableness versus unacceptability. There also needs to be an understanding that contractors are not wasting government money in a fixed price world.

Rhonda S. Summers

Rhonda Summers, claiming to be the eternal optimist, focused her attention on commercial item definitions. Expressing her goal as "working herself out of a job," Summers explained how her company is defining everything they can as commercial items in order to reap the benefits. These were described as no Disclosure Statement submittals, no need for resident auditors or inspectors (the one resident Defense Contract Management Command inspector is going away next year), and no future in-process inspection.

In addition, her company promotes a good teaming arrangement with the government customer. The government customer must be transparent to the commercial customers in completing transactions. Industry has to accept the fact that they cannot enjoy all the benefits of previous years. They need to accept risk. The payback will be less oversight.

During the question-and-answer session following the presentations, the panel agreed that real progress can be made in the commercial item arena. However, industry has to be careful that bad stories like $600 hammers are a relic of the past; otherwise, bureaucratization could creep back. In response to a question concerning what industry should do differently to make the process better, Monaghan replied, "Train the people within the company. It's to industry's advantage to make acquisition reform work." Summers added, "Remember, we cannot have our cake and eat it too. Reduce protests and accept risk." Kimzey responded, " Work on the people to get the change process understood. Do away with adversarialism." Lastly, Ireton replied, "Change attitudes — convince the government to make changes, and convince industry management to take risks."

Richard Sylvester – Luncheon Speaker

Richard Sylvester, Director of Acquisition Improvement Programs, Office of the Assistant Deputy Under Secretary of Defense for Acquisition Reform, delivered the luncheon presentation and provided a government perspective of acquisition reform. Answering the question, "Why acquisition reform," Sylvester explained, "We are not sure who we are fighting, where we are fighting, and what we will need. What we do know is that we have a declining Defense budget; a lot of the technology we need access to is coming out of the commercial marketplace and not DoD Laboratories. We are buying only a small amount of the systems we were previously, and we need to reform business processes to get weapons to our warfighters faster and cheaper."

Sylvester went on to describe the vision, purpose, and current goals of acquisition reform. He stated that the vision is to buy the best value from the global industrial base and to become the world's smartest, most efficient, most responsive buyer of best-value goods and services. The purpose of acquisition is to support the warfighter as a customer. To achieve acquisition reform's vision and purpose will require meeting or exceeding the following established goals:

- Move data electronically.

- Move from a regulatory-based system to one of guiding principles.

- Pay more attention to cost and use Integrated Product Teams (government and contractor).

- Move forward with the Single Process Initiative, and recognize it in new procurements.

- Use form fit and function replacements with new technology under an open systems initiative to allow integrated testing.

- Enact audit reform.

- Sustain existing systems and extend their life.

Sylvester went on to explain that metrics and goals are being developed in support of the National Performance Review. These are internal metrics for DoD Enterprise Acquisition. He further stressed that program stability is needed. Program Managers need technical risk money and threshold and financial flexibility.

During a short question-and-answer session following his discussion, Sylvester commented that it is unlikely there will be any changes in the Service Contract Act in the near future to facilitate commercial services. In addition, pulling back from contractor surveillance at the work package level on cost reporting and acceptance of contractor testing is dependent on trust and the comfort level of the people involved.

Office of Federal Procurement Policy Report

Day 2 of the Symposium began with opening remarks from Calvin Brown, Associate Dean of Research, DSMC, and a report from Dr. Steven J. Kelman, Administrator, Office of Federal Procurement Policy, Office of Management and Budget. Kelman proclaimed that acquisition reform is a celebration of all that has been accomplished in building an acquisition system. Changes, improvements, and innovations are constantly being provided by the front lines. In his view, acquisition reform is here to stay. The biggest challenge is to make acquisition reform, not something new, but something that is done every day. "Isles of innovation need to turn into a continent of good business practices." He focused his report on four activities: past performance evaluations, performance-based contracting, metrics, and cultural change.

Past Performance Evaluations

> **The biggest challenge is to make acquisition reform, not something new, but something that is done every day. "Isles of innovation need to turn into a continent of good business practices."**
>
> — STEVEN J. KELMAN

In the area of past performance evaluations, he stated that customer satisfaction has increased by 21 percent. As a result, past performance needs to be considered more often in the course of the contract rather than just used for source selection purposes.

In the area of performance-based contracting, Kelman claimed that contractors charge more than twice the price to perform services for the government than they charge their commercial customers. This is because government customers have only the vaguest idea of what they want at the onset of the contract, then figure out what they want later. In commercial work, the contractor is told up front what is wanted, when needed, and then left alone to perform the work. No further action is needed. This difference in approach drives the government to cost type contracts. The commercial world achieves fixed price services. To change the government perspective, a different, innovative form of contracting is needed.

In the area of metrics, Kelman felt they are strategically important. The acquisition workforce needs to be held accountable for results, price, lead times, etc. In doing this, the government needs to resist the natural tendency to gather more and more information and to rely on contractor data to track results. In addition, the contracting management chain needs to take some responsibility for its creation and limit the amount of reporting requirements.

In the area of cultural change, Kelman expressed the view that as long as the contracting workforce continues to see itself and its main source of activities as following the regulations, it will be a candidate for downsizing — no value added. Contracting professionals need to see themselves culturally, as the government's business people — experts at getting the government a good deal. There will always be a demand for people who have good business sense and can make a good deal.

During the question-and-answer session following the report, Kelman noted that government officials should be able to compete with contractors for work that is being outsourced. In addition, a centralized database for past performance is not necessary (although it has advantages, and an Agency should be able to use award fee evaluations in past performance determinations).

Civilian Acquisition Executives Panel — Innovation Outside DoD

Following Kelman, Deidre A. Lee, Associate Administrator for Procurement, National Space and Aerospace Agency (NASA), introduced and moderated a group of Civilian Acquisition Executives regarding activities that their agencies were implementing. The panel members were Ida M. Ustad, Deputy Associate Administrator for Acquisition Policy, General Services Administration; Dennis N. DeGaetano, Deputy Associate Administrator, Office of Research and Acquisitions, Federal Aviation Administration (FAA); and David A. Drabkin, Assistant Deputy Under Secretary of Defense, Acquisition Process and Policies.

Ida M. Ustad
Ustad addressed the current goals of the General Services Administration (GSA), which are to become a central management agency practicing effective competition, customer focus, and more efficiency. In this regard, GSA desires to become non-mandatory for everything they do. It wants agencies to use GSA services due to the quality of the service, not because they have to. To this end, regulations will be revised for agencies to purchase items through the GSA Advantage System hosted on the Internet. However, if an agency exceeds the maximum order limitation, it will be required to contact the vendor and ask for a price reduction.

During the roundtable discussion following the initial comments, Ustad explained that GSA is moving to a broad personal computer environment and intends to link the solicitation notice to the electronic *Commerce Busi-*

ness Daily notice for ease of access. GSA has outsourced everything it possibly can. Ninety-three percent of GSA funds went to vendors last year.

Ustad recognized that during this process there has been some consolidation of contractor effort, but noted that GSA is encouraging contractors to team and subcontract to mitigate this problem. GSA, in the future, will encourage a closer sharing of information and experiences to facilitate the implementation of future changes.

Dennis N. DeGaetano
DeGaetano offered his prescription for the future. In his view, source selection needs to be open and realistic rather than following a set of rules. The emphasis should be on doing what makes sense. By using this attitude, the FAA has been able to cut acquisition time in half. What once took a year is now taking six months.

One area of major concern, still, is the dispute resolution process. This is a very difficult process, and additional protests are being received. Another concern is the use of Small and Small Disadvantaged Businesses. Current incentives are taking away the need and ability to meet FAA's Small and Small Disadvantaged Business goals.

During the roundtable discussion following the initial comments, DeGaetano explained that FAA is taking full advantage of the commercial marketplace. Of the 800,000 lines of code on a new system, all but 100,000 were commercially available. Looking to the future, DeGaetano felt that the FAA program has been well accepted and will be available for use government-wide.

David A. Drabkin
Drabkin opened his discussion with a few short remarks on Performance Based Services Contracting. The Department of Defense (DoD) is looking very closely at this area in order to maximize opportunities to use commercial services and to provide better quality. DoD will be focusing on out-

comes in the future, not output or input.

During the roundtable discussion following the initial comments, Drabkin explained that DoD is determined to keep its commitment to small businesses in the area of electronic commerce. Using commercial practices in support of a product requires education and industry partnership. DoD needs to be able to take advantage of changes in technology and be able to keep small business a part of the process. Drabkin also addressed the new Federal Acquisition Regulation, Part 15 rewrite, which in his view, has three radical changes: open communications in source selection — a cultural change; only advancing contractors to the competitive range who are seriously being considered for award; and elimination of Best and Final Offers. The first DoD-broadcast training session on the new rule should occur in October. Drabkin concluded that change is the most difficult thing to achieve, but acquisition reform is here to stay.

David D. Acker Awards
A highlight of the Symposium was the presentation of the "David D. Acker Award for Skill in Communication." The successful awardees were chosen from the authors of the 69 papers submitted for presentation consideration at the Symposium. These awardees were announced following the panel discussion. The awards were presented to Navy Cmdr. N.D. Pisano for his paper entitled, "Technical Performance Measurement, Earned Value, and Risk Management: An Integrated Diagnostic Tool for Program Management"; and to Matthew E. Brislawn and Bruce S. Potocki, Boeing Corporation, for their paper entitled, "Application of Commercial Practices to Military Programs: Opportunities for Cost Reduction." Both papers are considered significant contributions to the acquisition workforce and enhance the concepts of acquisition reform.

Luncheon Speaker
Stephen K. Conver, Vice President, Business and Development, Lock-

STEPHEN K. CONVER, VICE PRESIDENT, BUSI-
NESS AND DEVELOPMENT, LOCKHEED MARTIN
CORPORATION — LUNCHEON SPEAKER,
THURSDAY, JUNE 26.

heed Martin Corporation, delivered the luncheon presentation. Conver spoke of himself as a survivor of the consolidation activities. Speaking on efficiency, he recognized former Deputy Under Secretary of Defense for Acquisition Reform, Colleen Preston, for her contribution to acquisition reform.

His message concerned the shrinking DoD budget and its effects on DoD's ability to put world-class equipment in the hands of the warfighter. Since 1985, the available dollars for acquisition declined about one-third, cutting the ability to acquire systems approximately in half. While DoD reduced force structure, the job is still challenging. Presumably, DoD would make up for the smaller force by putting more money in technology. Yet, the opposite is true. A major gap exists. The best DoD can plan for is that the budget remain flat. No one will solve the problem, so procurement must be funded from internal sources. As such, DoD must act more efficiently. Unfortunately, this means that research and development is being squeezed out of the picture. Conver then raised the question, "What can DoD do to find more money and spend more wisely?" He answered the question in three ways: make the acquisition process more efficient, since this is where money is translated into equipment; create budget stability; and reduce the infrastructure. He further stated that in his opinion, more money is wasted in the last two areas than if the acquisition process was improved tenfold.

Regarding budget stability, Conver stated that restructuring, cancellations, and stretch-outs waste an incredible amount of money. While the budget is beyond the control of DoD, there must be a way to ensure

ACQUISITION RESEARCH SYMPOSIUM

"What can DoD do to find more money and spend more wisely?" He [Conver] answered the question in three ways: make the acquisition process more efficient, since this is where money is translated into equipment; create budget stability; and reduce the infrastructure.

that requirements, technology, and funding are in balance to avoid some of the effects of instability.

Concerning infrastructure reduction, the political process is focusing on the wrong things. Currently, its concern focuses on the "jobs" issue and not the equipment. Defense should only be concerned with world-class equipment.

The acquisition process, according to Conver, still must be done better, faster, and cheaper. Eliminating military specifications is the single most important effort in achieving this objective.

Lastly, Conver felt that the United States needs to make some decisions regarding the industrial base. It should decide how much of an industrial base is needed and the most efficient way to ensure its viability. If this means competition is available, so much the better, but competition should not be the end objective. The market is a self-correcting environment.

Congressional Panel — Congressional Perspective on Acquisition Reform.

Day 3 of the Symposium opened with a few administrative remarks from Joan Sable, Research Associate, DSMC, who reminded attendees to evaluate the Symposium, followed by Mary Ann Gilleece who introduced and moderated a panel to provide a Congressional perspective. The panelists were Jonathon Etherton, Professional Staff, Senate Committee on Armed Services, Subcommittee on Acquisition and Technology; and Charles E. Rowe III, Counsel, House Subcommittee on Small Business.

Gilleece opened the discussion by noting that acquisition policy issues are currently focusing on implementation. A recent assessment showed that taxpayers are starting to see benefits. However, there still appears to be concerns about employee promotion system parity, knowledge, and the future of competition due to trends in the industry.

Jonathon Etherton

Following this thought, Etherton explained that any acquisition policy revisions in the Authorization Bill should be in Title II this year. In research and development, there is an allowance of 5 percent for new starts, ramped up to 10 percent over the next 10 years. A topical issue is the question of Executive Compensation as an allowable cost. Last year, it was capped at $250,000. The current proposal is to cap it at $340,000. No reductions of the AWF have been included in the Senate Bill, and there is no anticipated extension of the $5 million threshold for commercial items to other acquisitions. In Etherton's opinion, acquisition policy is at a real transition point. There appears to be no way to break the oversight cycle, and there is a new team in DoD. While the old team was very successful in pushing acquisition reform, building momentum with a new team may be a challenge.

Charles E. Rowe III

Rowe was concerned with the impacts of acquisition reform on small business. Small business wants acquisition reform, but in the context of fairness and competition. Regulatory implementation has created fewer opportunities for small business to compete. In addition, while there is a serious need for contracting people to have more flexibility due to increases in workloads, there are more opportunities for fraud, waste, and abuse. Therefore, in the interest of fairness, more documentation is needed. This means that documentation of oral presentations and the identification of the source of negative past performance information is necessary. A contracting official cannot justify award if this identification is not made. There are also serious problems in the implementation and use of FACNET. The inference is, it was tried, it did not work, so let's change it. If FACNET does not work, then it needs to be fixed, not done away with. A serious plan is needed, including an Internet solution.

Bundling is another complicated issue. Contract consolidation makes sense in some instances, but in others it has produced nothing but cost. The House is crafting language to govern consolidation requirements. Lastly, expanding the threshold for Simplified Acquisitions to $5 million is difficult. While the change would only affect 90,000 actions, this is another potential reduction of opportunity to small business. Simplified acquisition works, but to expand it based on minimal testing does not make sense. In Rowe's opinion, haste and speed are the enemy. Changes should be accomplished in well-measured, well-thought-out steps.

During the question-and-answer session following the presentations, the panel commented that acquisition staffing needs must be determined, and a Small Business Industrial Base must be maintained. In addition, multiple-award, task-order contracts are now opportunities to market agency officials rather than opportunities for work. This must be fixed.

Quadrennial Defense Review — Impact on Acquisition

Following the Congressional Panel, John F. Phillips, Deputy Under Secretary of Defense (Logistics), provided his thoughts regarding logistics and acquisition reform as they relate to the Quadrennial Defense Review (QDR).

Phillips began his discussion by pointing out some fiscal realities in DoD. Currently, DoD shoulders a readiness, quality of life, infrastructure, and modernization deficit; it needs to free up dollars to fix the problems. New systems are not the solution. DoD needs to leverage technical insertions and life extensions of existing systems, then posture new systems to be most efficiently run. Up-front digitization, reduced procurement lead times, paperless transactions, electronic funds transfer, total asset visibility, performance contracting, reliability improvement, spares reduction, and changes in the test process are all ways this can be achieved.

Phillips went on to express a concern over the issue of consolidation. If organizations get too large, problems surface. Maintaining competition is a necessity. Outsourcing alone is not the answer. The definition of "inherently governmental" also must be resolved to assure fairness in government/private competitions. The current 60/40 rule will probably be changed to 50/50 partnering in the near future. This requires changing the acquisition culture. Partnering is possible only if people feel comfortable.

Regarding logistics challenges ahead, Phillips felt that these included reduced cycle times, responsive readiness support, seamless systems, a streamlined infrastructure, and in-creasing competition for outsourcing. One remedy is to change the notion of *color of money*. Different funding forces people to do inefficient things.

Another is to regard a spare as a spare and do away with the notion of wholesale and retail. Diminishing manufacturing sources and technology obsolescence are causing parts shortages. Total asset visibility, manufacturing on demand, reducing mean-time-between-failures through technology insertion, and digitizing manuals are possibilities for solving the problem.

Lastly, DoD needs one source of information with access to the environment. This means integrating legacy systems through the use of a universal translator. Depots must be linked through the magic of technology — a virtual enterprise industry, a shared data warehouse. Phillips concluded that this will provide DoD assured victory to whatever threat, at minimal cost.

DoD Service Acquisition Executives Panel — Looking Ahead

Following Phillips' presentation, Richard Sylvester introduced and moderated a group of panelists representing the DoD Service Acquisition Executives, which convened to discuss and consider upcoming issues within DoD. The panelists were Gary S.

Thurber, Associate Director for Acquisition, Defense Logistics Agency and Deputy, Defense Contract Management Command; Blaise J. Durante, Deputy Assistant Secretary for Management Policy and Program Integration, Office of the Assistant Secretary of the Air Force; Daniel E. Porter, Department of the Navy, Acquisition Reform Executive, Acquisition Reform Office; and Army Brig. Gen. Harry Gatanas, Assistant Deputy for Systems Management and Horizontal Technology Integration.

Army Brig. Gen. Harry Gatanas
Gatanas opened the discussion and addressed the realities of acquisition reform. The Army is currently using 25-year-old trucks with automatic transmissions. These need to be modernized to use cell phones, etc. The activity is underfunded by $94 million. In January, program managers will be asked to identify ways to accomplish a 20-percent cost reduction to provide the money to modernize – about $700 million.

Daniel E. Porter
Porter addressed the status of the Navy regarding acquisition reform. He stated that the workforce believes they are making a difference. Citing the Naval Acquisition Center of Excellence, the Navy is moving to a philosophy of tool development. Turbo Streamline for solicitation development is currently available and Turbo Specifications, which turns military specifications into performance specifications, is currently being developed. In addition, the Navy is making every attempt to recognize individual effort and team innovation. As a result, under the Commercial Savings initiative, the Navy generated about $2 billion in savings.

Blaise J. Durante
Durante, addressing the Air Force perspective, felt that several things must be attacked. First, the Air Force needs an acquisition business plan that will rely on the innovation of the workforce to meet Air Force goals. This would include mirroring industry

business practices, leadership commitment, and measurable milestones. It would provide a corporate focus to business process improvement. With big manpower cuts, the necessity for modernization and decreased funding, affordability has become a key performance parameter, forcing the Air Force to make tough budget decisions.

Gary S. Thurber
Thurber discussed the progress of the Defense Contract Management Command (DCMC). Explaining that DCMC facilitates initiatives that the Services develop, he reported that the Single Process Initiative is alive and well. DCMC has received over 1,000 proposals and 500 change requests. In the area of earned value, DCMC is adopting industry practice, wherever possible. This facilitates one review process for DCMC and the Services. As far as future activities are concerned, DCMC is actively identifying excess property and taking action to "get it off the books," looking at ways to reduce acquisition pollution, and taking a hard look at the source inspection process.

During the question-and-answer session following the presentations, symposium participants asked the panel to address program stability, Acquisition Corps reductions, and the Standard Procurement System (SPS).

In the area of program stability, the panel expressed concern that it diverts attention from good management. There needs to be a recognition of uncertainty, since it results in increased program cost. Contractors can help by spending obligations as they propose for constancy in execution.

On the issue of the Acquisition Corps, all expressed concern over the reductions and loss of expertise. There was a feeling that there must be increased training and Corps' stability.

On the issue of SPS, the panel agreed if the system does not meet expecta-

tion, DoD is in trouble. Deployment has already begun. Although it is an excellent system, the challenge will be looking at the people and the processes and determining how to do business differently.

In summary, Porter felt that there is still resistance to change due to fear and a perception of loss of power. This will only go away when acquisition reform is put into practice. Durante felt that drawdowns threaten jobs, there is no safety net, so it is hard to be innovative. There needs to be a hard look at finding people jobs, laying out business processes, and understanding the value of middle management. Thurber continued this thought by stating that change agents come from middle management. There is a need to harness their expertise on multi-functional teams and maintain that core experience. While Gatanas felt that DoD has only scratched the surface regarding the use of industry ideas, DoD needs to actively encourage industry to come forward and propose those things that work well. All agree that while DoD is moving in the right direction regarding reform, it is still easy to fall back. The new DoD team must decide whether it will be self-sustaining.

In Conclusion
On behalf of DoD's warfighters, David A. Drabkin thanked the Symposium participants for attending and contributing to DoD's future acquisition efforts and initiatives. He concluded by stating that the acquisition reform professional will make reform happen. He or she will achieve this by getting the best value – through market research, managing risk, providing tailored solutions (one size does not fit all), and reduction of life-cycle costs (including disposal).

Editors Note: The 1997 Acquisition Research Symposium Book of Proceedings, incorporating the submitted research papers, is available for $35.00 from the NCMA Book Service, (703) 684-4057.

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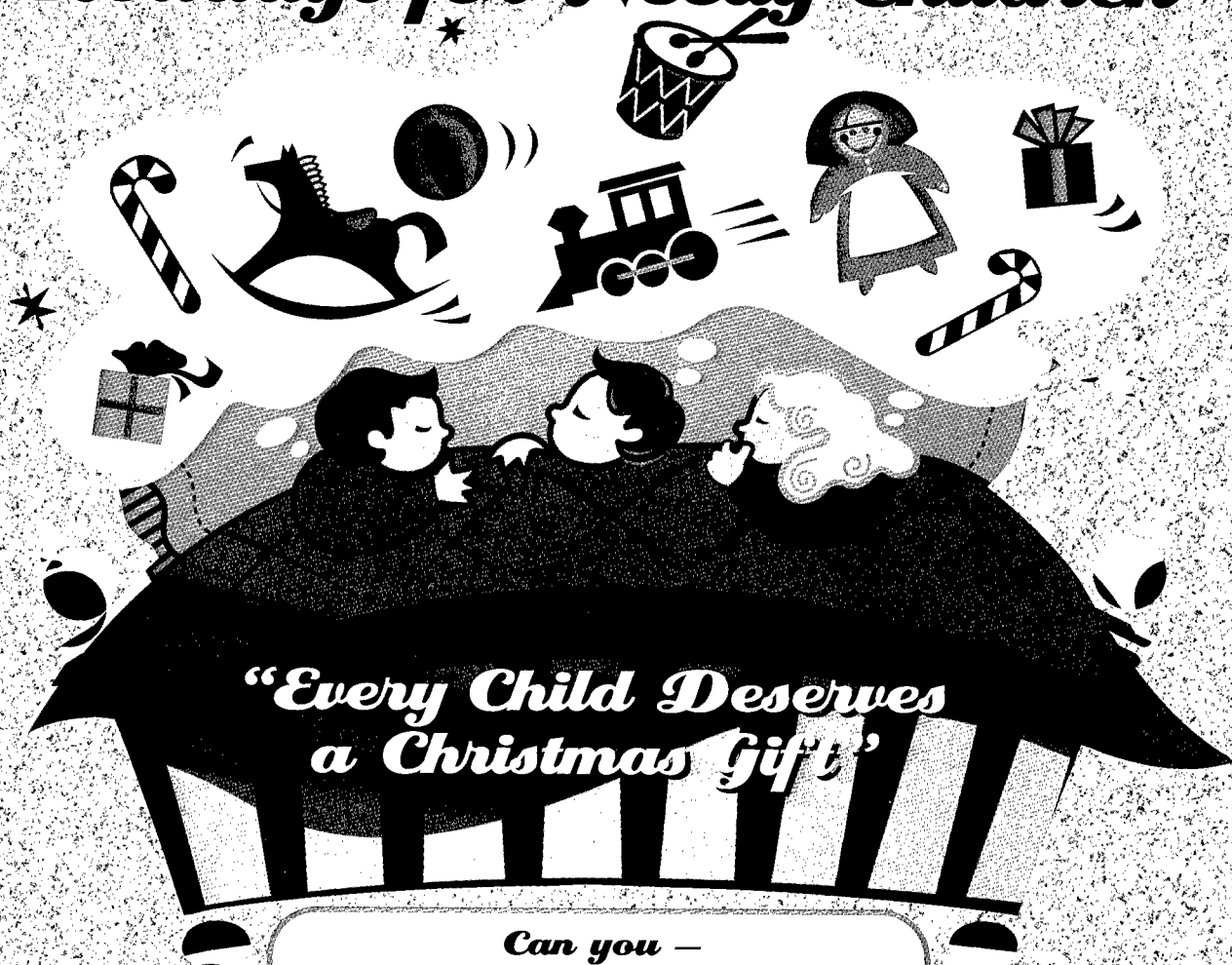
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Breaking Up Is Hard to Do...

DSMC's Central Region Closes Soon, Leaving Behind More Than An Empty Classroom

PATTY PREDITH

"What?" "Really?" "How Come?" "Gee, where will we go now for more of your training courses?" These are just some of the questions being asked of me when they hear that the Defense Systems Management College (DSMC) Central Region in St. Louis, Mo., will be closing effective September 30, 1997. The last class will be ACQ 101, Fundamentals of Systems Acquisition Management Course, held in late August.

Why Close?

Due to the 1995 BRAC (Base Realignment and Closure) initiatives, resulting in population shifts within the acquisition workforce, the Defense Acquisition University (DAU) and DSMC made the tough decision to close the Central Region in St. Louis. DAU, working closely with DSMC, selected another site in close proximity to the acquisition workforce that would meet the increasing demand for acquisition courses and make them more accessible to acquisition professionals. The site chosen was Fort Monmouth, N.J., and on April 11, 1997, the new DSMC Mid-Atlantic Region opened for business. The new region is now the hub for over 10,000 Defense Acquisition Workforce Improvement Act (DAWIA) personnel located nearby at Picatinny Arsenal, Lakehurst Naval Air Warfare Center, and the Defense Personnel Support Center in Philadelphia.

In the Beginning

DSMC opened the St. Louis campus in January 1985, with Dr. Julius Hein as the regional director. He remained the director until his retirement in

JIM AND PATTY PREDITH (CENTER) PICTURED WITH STUDENTS FROM CENTRAL REGION'S NEXT-TO-LAST COURSE OFFERING — ACQUISITION WORKFORCE TEST AND EVALUATION COURSE. ALSO INCLUDED IN THE PHOTO ARE MEMBERS OF THE DSMC STAFF AND FACULTY.
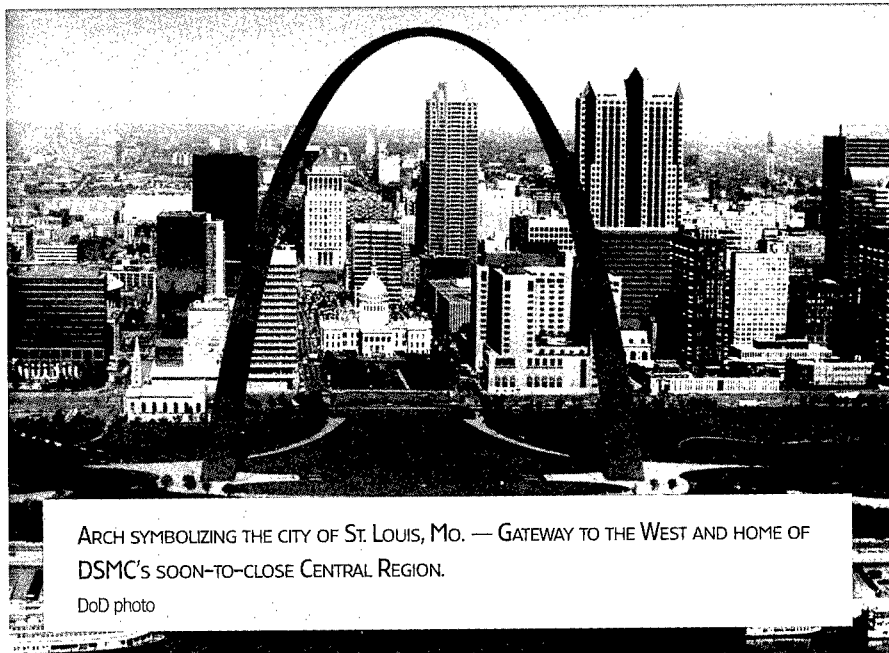
ARCH SYMBOLIZING THE CITY OF ST. LOUIS, MO. — GATEWAY TO THE WEST AND HOME OF DSMC'S SOON-TO-CLOSE CENTRAL REGION.

DoD photo

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very heavily staffed — Patty and myself." Actually, the large, well-staffed "phantom" office and classrooms envisioned by the students paled in comparison to the very real and vast Central Region geographical area, which covered 22 states in the Midwest.

Early on, the director often visited the Midwestern states for consultation with the region's DSMC customers. One of his foremost priorities was to update the various military commands, facilities, agencies, and defense industry customers on the acquisition courses offered at the Central Region, certification procedures, and entry requirements. In return, he received and acted on feedback as to what training the customers really desired.

September 1996. The opening of the region was precipitated by the demand for DSMC courses in the Midwestern part of the United States, and the impetus to save TDY cost expenditures incurred when sending students to the main campus at Fort Belvoir, Va., for resident instruction.

The Central Region staff consisted of the regional director and a regional management assistant, two offices, one small workroom, and one classroom. In 1993, we acquired two more rooms that were turned into the student's breakout room and refreshment/phone area. Dr. Hein always laughed when students came to class and couldn't believe this regional office was run by just two people. They envisioned at least one large building with numerous classrooms and personnel. In his introduction to classes he'd always say, "The office is

With the passage of DAWIA in 1991, customers realized training would be a big need. Due to the mammoth number of students needing and wanting acquisition training, the Central Region enlarged its lone classroom to help accommodate larger class sizes. Often the customer would request that

Central Region conduct the classes at their installation, activity, or agency.

During that extremely busy time, there didn't seem to be enough hours in the day or weeks in the month to provide the training needed for those in the Central Region. The region class schedule was often full, with many courses taught back-to-back for up to 12 weeks at a time.

After a couple of years, we became acclimatized to students begging to get in classes, and eventually settled down to a more "even keel of madness." Local students would often come to me the morning a course would start in hopes of getting a "no show" seat. I remember the first days at registration for the short courses, particularly ACQ 101 and 201. I kept thinking, "Sure hope all the registered students on the roster show up – then I won't have to worry about the brawl over which one will get in due to a 'no show' space."

It's Nice to be Needed

I have often said of my position, "you might not have to know a lot about one thing, but you better know a little about everything." The students made me come to this realization. Considering that they are coming from all parts of the world, cultures, military services, and situations, and not being in their own work environment; I had to have the ability to, at the very least, help them find answers to their own, unique questions.

Actually, in many ways, the students taught me. I live on the Illinois side of the river, so I personally learned a great deal about the St. Louis area and our ATCOM [Aviation Troop Command] facility through needs of the students. I found a dental referral number; a check cashing shop down the street I never even knew existed; a great gyros sandwich restaurant; who you call when the ATM sucks up your card and keeps it while you're on TDY [if you could have only seen the look in his eyes]; the fastest route to the nearest hospital [for the man I took to
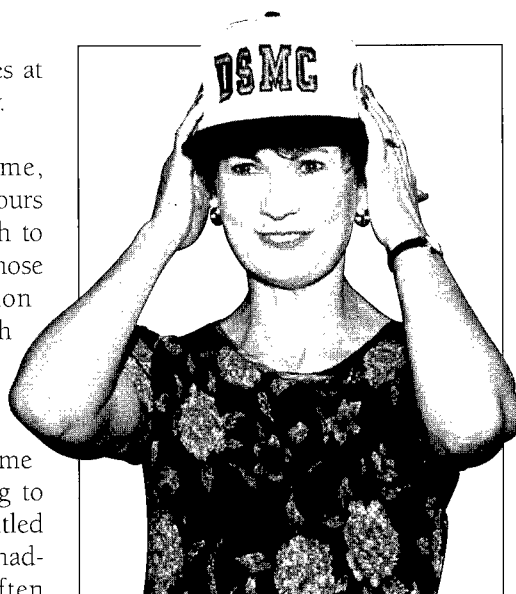
To be chosen one of the guests of honor at a ceremony honoring our country's men and women in the Marines was to be a part of something bigger than those of us gathered in the room. We were caught up in the heritage and spirit of our country's "proud but few" — truly an experience I will never forget.

the local health clinic, who was literally having a heart attack right before my eyes, and was transferred by ambulance the rest of the way to DePaul Hospital]; how long it takes for a package to be sent to Korea; where the best camera repair shop is in St. Louis; or in the words of Yul Brynner as the King of Siam, "etcetera, etcetera, etcetera."

My basic philosophy was to try and have the directions, maps, phone numbers, locations etc., available to the students before they arrived in St. Louis, or as soon as possible once class was in session. My goal was to minimize the anxiety of being in a new place and not knowing where to go or whom to call. I often thought about

what I would do if I was in their shoes – just what would I want and need to know about where I was going.

I definitely feel a great sense of accomplishment at the end of a class when a student stops by or drops a note to tell me that the class was very organized and efficient, and I provided them numerous sources of information to ease their stay away from home.

Lots of Laughs, A Few Tears

With so many students passing through our doors, I've seen and heard lots of funny and sad stories. Let me relate three memorable occasions. The first took place during an ACQ 201 class conducted at the Central Region for four weeks, a couple of years ago.

November 10th is the Marine Corps birthday. We had a couple of Marines – one active officer and one enlisted student. They were out-of-town students and had brought their dress uniforms for the much-anticipated and historic day. In fact, the officer also brought his sword just for the occasion. We had purchased a cake and decided on a small ceremony. The ranking Marine Corps student asked if there were any students, industry or government, who had been in the Marines so they could invite them to participate in the mini ceremony. Since there were none, the two began the ceremony, asking all students in the class to stand for the reading of General Lejuene's 13th Commandant's Message.

The two Marines told us that had they been at their home duty stations, a very impressive ceremony is usually conducted, with an additional reading of the present Commandant's message and other festivities. When it came time to cut the cake, the first two pieces normally go to the oldest and youngest as guests of honor. Inasmuch as Dr. Hein was on TDY that day, they asked me to be one of the guests of honor. In keeping with tradition, the first two pieces of cake were cut with the sword, and one passed to me as a guest of honor, after which everyone joined in the celebration.

For me personally, it was a profound experience of patriotism and pride, mingled with ceremony and tradition, that I will never forget. To be chosen one of the guests of honor at a ceremony honoring our country's men and women in the Marines was to be a part of something bigger than those of us gathered in the room. We were caught up in the heritage and spirit of our country's "proud but few" – truly an experience I will never forget. Nor will many others; we were absolutely riveted, with hardly a dry eye in the room.

Just about every weekly survey commented on the ceremony. In fact, the industry students were most impressed and stated they felt very honored to be part of the class to observe the tradition of honoring the Marine Corps Birthday.

In another class we had a Japanese Air Force major. He and another Japanese officer had been sent stateside for six months to enter a crash course in English and to take a number of American government training courses; our ACQ 201 was one of them. A week prior to the class start date, I had no classes and was in my office working. All of a sudden a soft voice said, "Excuse me. Is this where the acquisition courses are held?" After acknowledging that this was the right place, we started talking. The major had driven by car *all the way from California*, and was checking the location of the class, facility etc., before Monday so he wouldn't get lost or be late on the first day of class.

After a short time I realized that he had brought his family; a wife and a boy and girl, about 7 and 8. Just by chance, I happened to ask him where they were. When he replied, "Sitting outside on the bench," I told him without hesitation to bring them in. What a change of pace for a routine workday!

It really changes your perspective to view your workplace through the eyes of a child. There they were, two small,

excited little kids at a place where "Dad was going to go to school." Over a can of pop, they told me about their travels and their guinea pig, who was making the voyage with them.

My admiration for the man grew each day watching him in the course. He had his dictionary by his side on the table at all times. Often when students were on breaks, and before and after class, there he'd be – endlessly translating. I believe the plan had been for both Japanese officers to be in the same courses together during the six months in the states as backup to each other. However, it did not work out for this course offering. Not only was he in the states on crash training, he ended up alone in the class with no backup. He had to understand a new language, a new culture, and not only be tested on the material, but pass the course with a better-than-average score. To do less, in his culture, was unacceptable. The pressure on him must have been enormous – it was more than I could imagine myself undertaking.

The class really enjoyed his humor and candor. He even gave a small speech during the last week. He talked about how he joined the Japanese Air Force and what was expected of him. When he was done with ACQ 201, he was off to Boston for another adventure with his family.

I guess one of the most fun times we had in the class was when one student's wife was expecting their first child. At the time, the ACQ 101 course was ongoing. Because she was due any time, the student told the instructor that he was carrying a cell phone. Fortunately the student was local so the trip wouldn't be too far. The instructor was lecturing and the phone rang. By now, all the students knew the nature of the call, and out of courtesy [or more likely curiosity] became quite still and quiet. Turning a bit red, the student picked up his phone. It was like the E.F. Hutton commercial – all eyes were on him. From the back of the room came a piercing yell, "Bring

home a loaf of bread, Honey." The class could hardly contain themselves.

After a minute, our poor student and the object of all this good-natured derision, hung up the phone and embarrassingly said, "Sorry, false alarm." Nothing like having a class of 48 listen to your every word. As it turned out, she had the baby on the weekend when he was home.

It's Nearly Time to Lock the Doors

Thinking over the events I've related in this article brought to mind how fast the six years have gone by since I started with the Central Region. When our host command, ATCOM, was notified that they would be on a 1995 BRAC, I didn't really give it a second thought regarding our regional office. The number of students coming to St. Louis still seemed to be high. Since we were a tenant on the facility, and not actually a part of the BRAC, I could sit back and watch it all unfold in 1995. I never worried. Why? Because 1997 was an eternity away...or so it seemed.

As is usually the case, time rolls on faster than one expects or may want. Here it is 1997 already, and September is just around the corner. It has come quicker than I care to think about actually! I've been most fortunate to have been given the responsibility of managing DSMC in St. Louis through its final phase and affording the students and faculty a home away from home. With the luck of the Irish, I'll find a new job and take to it all my many experiences and lessons learned by the time the doors close.

Thank you DSMC for giving me a great experience!

Editor's Note: Married to Jim Predith, an ATCOM employee, Patty has three children: Colin, Ashley, and Hilary. In addition to looking for a new job, her future plans include visiting Colin who will be studying in Phoenix; visiting Ashley next year when she studies abroad in England; and enjoying Hilary's high school activities.

ike many other career acquisition professionals, I read *Program Manager* to keep abreast of new trends and acquisition concepts. As a member of the Army Materiel Command (AMC) Working Group for Integrated Product and Process Management (IPPM), I read with great interest the article in *PM* magazine's July-August 1997 issue titled, "21st Century 'Own the Night' Warfighter Requirements." Our working group is very interested in the multiple uses of Integrated Product Teams (IPT) throughout DoD, and especially within Department of the Army. I am troubled by some trends that I'd like to share with your readers. One is the apparent overuse of Integrated Product and Process Development (IPPD) terminology.

Many committees, working groups, and process action teams are inappropriately labeled IPTs. An IPT is a multifunctional or multidisciplined group pulled together to collectively determine how to execute a program. In the case of a product development, this group or team should include representatives from all organizations, from the developmental contractor to the user, that may have a stake in the program's life cycle. Our AMC Working Group, for example, has representatives from many organizations, but it isn't multidisciplined, so we do not consider ourselves to be an IPT.

The article discusses Overarching IPTs (OIPT) and Working Level IPTs (WIPT) formed by a PM Office. OIPTs and their WIPTs, as defined by DoD 5000.2R and reiterated in Army Regulation (AR) 70-1, should be oversight bodies that provide direction to and evaluation of PM program readiness for milestone transitions. Also, these bodies are not formed by PMs, contrary to what is written in the article. The group of managers identified in the article would have more appropriately been labeled a management team than an IPT.

This brings me to my last issue. DoD wisely mandated OIPTs for ACAT I and II programs because they work, i.e., reduce multiple review layers inherent to these programs. Department of the Army, via AR 70-1, recently mandated their use for ACAT IIIs and IVs. This has the potential of adding a layer or two of bureaucracy prior to each milestone review. As an example, consider that the membership on milestone decision reviews for many ACAT III programs is often a subset of the total membership on the PM's IPT(s). For such programs, it would seem more prudent for the Milestone Decision Authority (MDA) not to establish an OIPT.

IPPD has been highly beneficial to DoD. Its application must be tailored appropriately to fit the size and complexity of each individual program. This flexibility should include being able to empower a single IPT to execute a PM's development and advise the MDA prior to milestone reviews throughout the program's life cycle.

– **Bruce Buckland**
Mechanical Engineer
U.S. Army Soldier Systems
Command
Member, AMC IPPM Working
Group
Natick, Mass.

I just reviewed the current issue [May-June 1997] of *Program Manager* and found it outstanding! You have added a lot of human interest items as well as the normal substantive articles. Congratulations on a very interesting, graphically attractive publication. I know how difficult changes like this are to bring about. Best Regards.

—Ret. Army Lt. Gen. Lawrence "Larry" Skibbie
Arlington, Va.
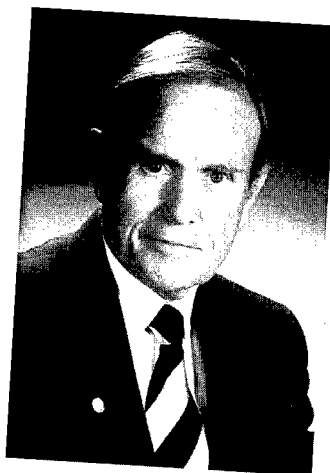
Editor's Note: Skibbie is President of the American Defense Preparedness Association/National Security Industrial Association (ADPA/NSIA), which publishes *National DEFENSE*, ADPA's business and technology journal.

▲

I have just read, cover-to-cover, the May-June 1997 issue of your fine publication. I've been starved for acquisition news like this for a few years now as my subscription somehow got lost as I was reassigned. This was the first issue I've read in two years, and must have resulted from my request at the DSMC Internet Home Page. Currently, I am completing a three-year assignment in the Japan Air Self Defense Force (JASDF) as an exchange officer. In my previous life, I was an Air Force Acquisition Officer and a 1992 graduate of the Program Managers Course. For the last few years, I've been "on loan" to JASDF's flight test organization.

My most popular lesson attempts to describe the DoD acquisition process. This has been an interesting challenge as the process constantly changes and mutates along with reform initiatives. To stay current, I've used my stock of DSMC publications, the Internet, and the Defense Acquisition Deskbook. I wish I had received the *Program Manager* magazine regularly dur-

ing the last few years, but that is "runway behind the aircraft."

I want to echo a point that Dr. Paul Kaminski made in the Q&A session article on p. 21. He noticed a great interest among his counterparts, both in Europe and Japan, on reform issues – especially with regard to MilSpecs. I answer questions from all levels of the Japan Self Defense Force acquisition structure on these issues nearly every day, and completely understand his point – my hosts are very interested in what we are doing and why we are doing it. It is simple to tell them what the changes are, but I think it is important to know who is asking the question and why. The United States should understand something about the foreign acquisition system too. Cultural, diplomatic, and business practices' differences are important to know as we explain our changes.

After being part of the Japan acquisition system, it is easy for me to understand why my hosts are concerned if the U.S. Government moves away from MilSpecs. Basically, Japan accepts and uses U.S. Government MilSpecs, not just in programs teamed with the U.S. industry, as in the question posted to Dr. Kaminski; the Japanese use U.S. MilSpecs for their own domestic programs. Nearly all Japan Government tests focus around verifying the product meets the specification. If there is no longer a MilSpec – the government process is at a loss as to what to test since they don't control the contractor developmental specifications.

I was a bit surprised that the magazine does not have a "Letters to the Editor" section. Either there aren't very many letters because readers are too busy, or no one has a comment regarding the content. The former is understandable, but the latter is not likely. I hope my letter changes this trend.

Keep up the fine publication, and hope I don't miss any more issues.

– **Air Force Maj. Samuel G. Carbaugh**
  Japan Flight Test Exchange Officer
  Pacific Air Forces

Editor's Note: We regularly publish our letters to the editor under the folio "From Our Readers." For the May-June 1997 issue of *Program Manager*, however, there were none.

DSMC Graduate Tapped to Lead Army's Acquisition Corps

Kern Replaces Hite

"Part of the [acquisition] challenge is to make sure we all understand [weapon system] capabilities, can articulate test issues, and fix problems. Secondly, we need to be able to explain our systems to people who may not understand the technical points."

On June 20, 1997, the Army announced the nomination for promotion to lieutenant general of Army Maj. Gen. Paul J. Kern, formerly the Commander of 4th Infantry Division (Mechanized) at Fort Hood, Texas. Simultaneously, officials announced his reassignment to become the new Military Deputy to the Assistant Secretary of the Army for Research, Development, and Acquisition (ASA[RDA]), replacing Army Lt. Gen. Ronald V. Hite, who retired June 30, 1997.

The Army's Acquisition Corps stands to gain a military leader who brings extensive command and acquisition experience to the job. In addition to his duties as the Military Deputy to the ASA(RDA), Kern will serve concurrently as the Director of the Army Acquisition Corps, of which he is already a member. Totaling about 2,300 military and 24,000 civilian employees, the Army's Acquisition Corps and workforce manages the development, integration, acquisition, and fielding of complex weapon systems.

A native of Orange, N.J., Kern graduated from West Point in 1967. He is also a 1982 graduate of the Defense Systems Management College's Program Management Course at Fort Belvoir, Va.

Kern learned to navigate his way around the Army acquisition system while serving as the branch chief of Bradley Fighting Vehicle Systems, U.S. Army Tank-Automotive Command (TACOM) in Warren, Mich. There he was involved in developing and fielding the Bradley from 1979 to 1982. Ten years later, as the Commander, 2nd Brigade, 24th Infantry Division, he observed the Bradley's performance under actual combat conditions during Operation Desert Storm.

According to Army press releases and news sources, Kern said that he is excited about moving into the Acquisition Corps leadership, honored to be nominated for his new position, and anxious to "get started."

Editor's Note: According to the ASA(RDA) staff, Kern reported for duty as the Military Deputy to the ASA(RDA) on July 7, 1997.

DSMC, San Diego Conduct Technology-Based Education and Training Trial Run

Video TeleTeaching (VTT) Link-up Offers Opportunities, Challenges, Cost Savings

COLLIE J. JOHNSON

Sixteen months ago, when Army Brig. Gen. Richard A. Black first became the Commandant of the Defense Systems Management College (DSMC), it didn't take long for the staff and faculty to realize that one of his foremost priorities was an educational method of instruction called *distance learning*, now referred to as *Technology-Based Education and Training*.

Technology-Based Education and Training was a natural spin-off from the video teleconferencing technology of recent years. If conferences could be conducted via two-way audio-video, then certainly this same technology could be applied to education. Black had seen the method work marvelously well at other facilities, with substantial savings in time and money. Under his management and direction, DSMC subsequently adopted Technology-Based Education and Training [distance learning] as Strategic Goal No. 2 in its 1997 Corporate Plan.[1]

The Defense Acquisition University (DAU) was also keen to exploit the use of technology in course delivery, such that it included as part of its management strategy, a goal of at least 10 percent of DAU courses converted to the use of information age technologies before the end of FY 97. On June 5, 1997, DAU published its *Technology-Based Education and Training Plan,*[2] a
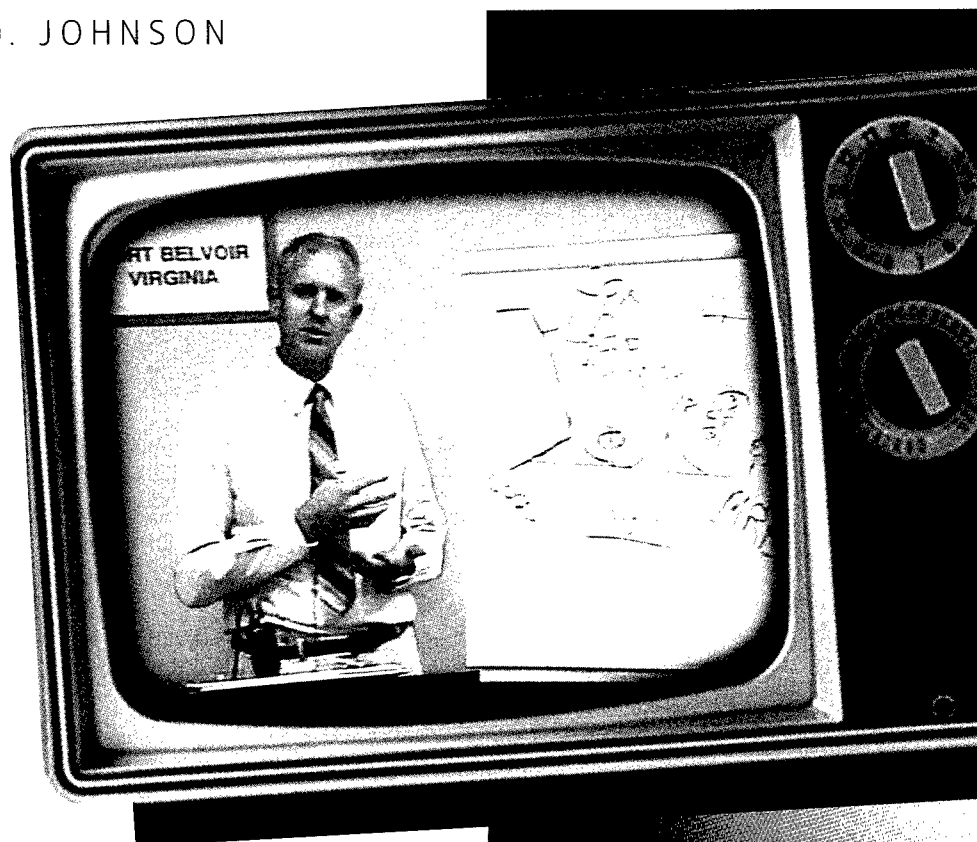
CONSISTING OF TWO-WAY AUDIO AND TWO-WAY VIDEO COVERAGE, DSMC'S NEW VIDEO TELETEACHING (VTT) SYSTEM CALLED *PICTURE-TEL,* LINKED AIR FORCE LT. COL. DAVE SCHMITZ, MANUFACTURING MANAGEMENT DEPARTMENT, FACULTY DIVISION, TO AN ACQ-201 CLASS IN SAN DIEGO

detailed curriculum transition strategy that will result in a dramatic increase in classes and courses delivered via distance learning and continuing edu-

Johnson is Managing Editor, Program Manager magazine, Visual Arts and Press Department, Division of College Administration and Services, DSMC.

cation throughout the DAU consortium schools.

Trial Run

Following DAU's lead, on June 16, 1997, DSMC completed a trial run of the use of Video TeleTeaching (VTT) at its main Fort Belvoir, Va., campus. Speaking from the College's Management Deliberation Center, Air Force Lt. Col. Dave Schmitz, Manufacturing Management Department, taught a series of three lessons on manufacturing management objectives, six hours in all, marking DSMC's first DAU

lessons to be offered under the auspices of Technology-Based Education and Training.

From Belvoir to San Diego

Consisting of two-way audio and two-way video coverage, DSMC's new VTT system linked Schmitz to an ACQ-201 class in San Diego, Calif. As part of the instruction, the class of 51 students, located at San Diego's Space and Naval Warfare Systems Command (SPAWAR), participated in two-way, question-and-answer dialogue over the VTT link. DSMC's Western Region Director, Bob Tate, acted as the in-class facilitator. Under his guidance, the class also completed several in-class, practical exercises.

Pulling It Together

For some time now, DSMC has been doing cooperative VTT work with the University of Texas at Austin (UT-Austin), using equipment provided by UT-Austin. Recognizing the need for its own equipment, the College recently purchased a *Picture-Tel* video conferencing system that allows two-way audio and video over switched digital phone networks for little more than the cost of an ordinary telephone call.

Bringing DSMC on-board with Technology-Based Education and Training was a College cooperative effort. Unofficially labeled the Integrated Product Team for Supporting the College's Technology-Based Education and Training, several staff and faculty members blended their talents to develop the curriculum, coordinate the class sessions, resolve any automation difficulties, produce the final lesson plans, and manage the technical aspects of the VTT link-up:

Faculty Division
Rich Reed, Dean
Bill Motley, Director, Manufacturing Management Department
Air Force Lt. Col. Dave Schmitz, Professor of Manufacturing Management
Dr. Tony Scafati, Director, Education Department

DSMC's WESTERN REGION DIRECTOR, BOB TATE, ACTS AS FACILITATOR FOR THE ACQ-201 CLASS ON THE RECEIVING END OF SCHMITZ' INSTRUCTION. THE CLASS OF 51 STUDENTS, LOCATED AT SAN DIEGO'S SPACE AND NAVAL WARFARE SYSTEMS COMMAND (SPAWAR), PARTICIPATED IN TWO-WAY, QUESTION-AND-ANSWER DIALOGUE OVER THE VTT LINK. UNDER HIS GUIDANCE, THE CLASS ALSO COMPLETED SEVERAL IN-CLASS, PRACTICAL EXERCISES.
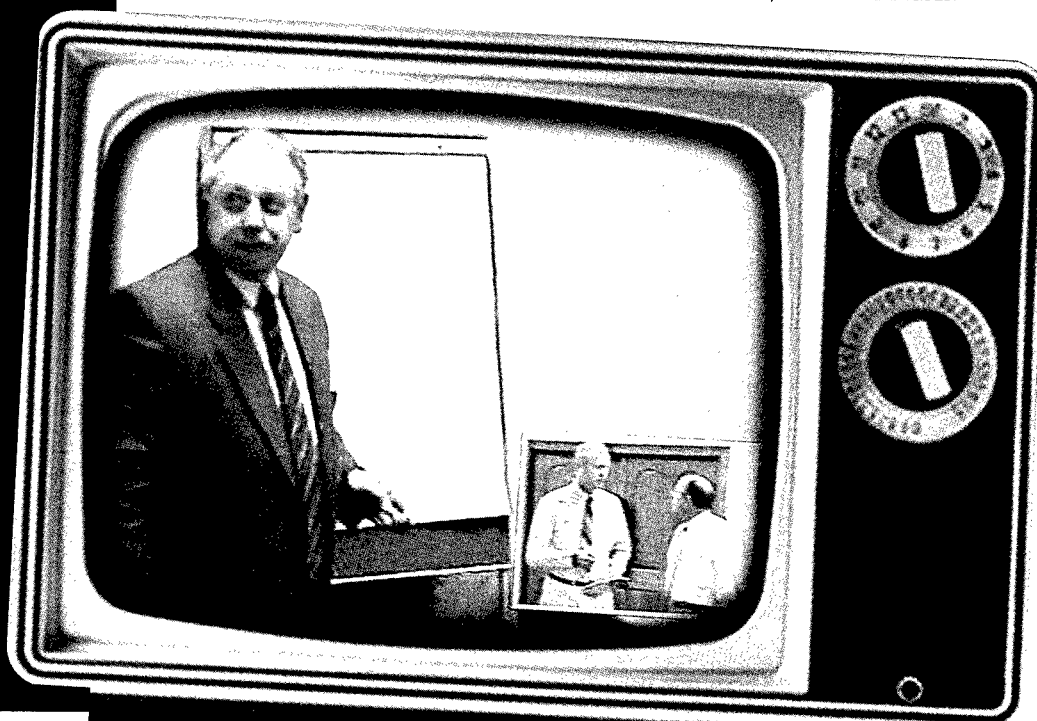
Stan Crognale, Director for Technology-Based Education and Training
Jim Leaf, Technical Advisor and Scheduler
Carolyn Miller, Course Design and Educational Specialist
Jeanne Elmore, Course Design and Educational Specialist

(The College situated the IPT in the Faculty Division, Education Department, to provide assistance and support for faculty members and course directors who wish to experiment with Technology-Based Education and Training. Crognale succeeded Dr. Bob Ainsley, who established the original Distance Learning Office at DSMC in 1988. Leaf advised the Faculty Division on the technical aspects of video teleconferencing and scheduled the VTT courses. Miller and Elmore conducted the internal training necessary to prepare DSMC faculty for teaching in the VTT format.)

School of Program Management Division
Dr. Craig Lush, Associate Dean
Air Force Lt. Col. Bob Traube, Director, Intermediate Acquisition Management Department

Video Services Department
John Garnish, Director
Army Sgt. 1st Class James Buffin, Production Technician
Air Force Tech. Sgt. Mike Bustamante, Maintenance Technician
Army Staff Sgt. Martha Haygood, Production Technician
Petty Officer 2nd Class John Miller, Maintenance Technician
Petty Officer 1st Class Ken Rector, Maintenance Technician
Army Sgt. Tyree Stanford, Production Technician
Army Sgt. Eric Whitted, Production Technician

Other important players in coordinating and supporting the College's first Technology-Based Education and Training initiative were Navy Rear Adm. George Wagner, Commander, SPAWAR; Lisa Brown, who operated the equipment in San Diego; and
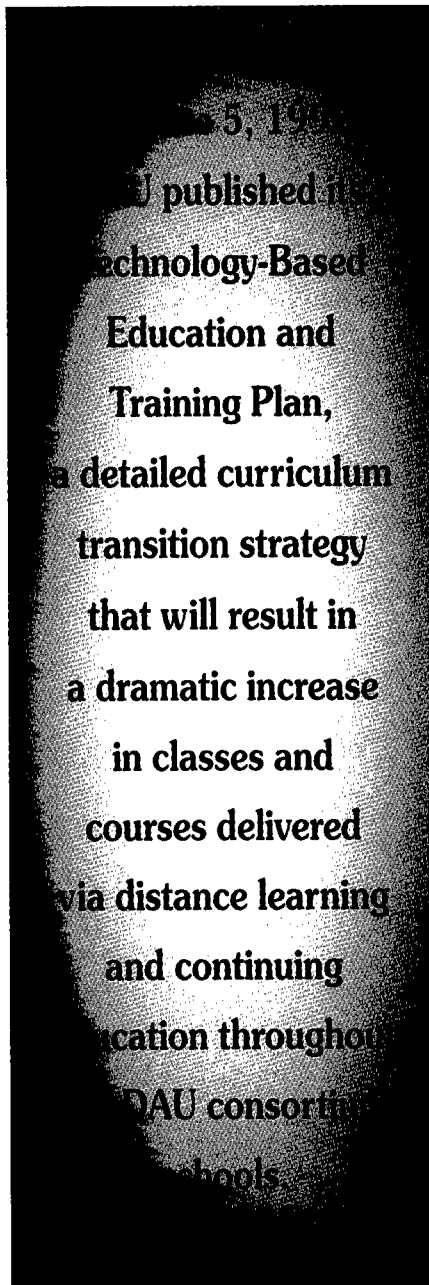
Navy Lt. Mark Burget, SPAWAR, who ensured the equipment was configured for not only the VTT, but several dry runs and training sessions. (On June 24, Wagner visited the College to offer his thanks and future support of DSMC's VTT initiative. Participating in the Acquisition Research Symposium the following day, he also took advantage of the opportunity to view first-hand, a breakout session demo of VTT.)

And finally, Lisa George, DSMC's Western Region Management Support Assistant, worked tirelessly with Bob Tate, the Western Region Director and San Diego facilitator, to arrange stu-

dent transportation to the VTT site and manage other critical aspects of the trial run.

Student Feedback
Overall, the event was very well received by the students. A survey conducted revealed that 40 percent of the students said that technology-based education and training was at least as good as in-class presentation that would "require them to be away from work and home (i.e., TDY) for the duration of the class." Based on many constructive comments from the students, DSMC was able to pinpoint areas requiring increased attention or improvement.

Moreover, the San Diego trial run, long anticipated and worked toward, represented a huge leap for the College; instead of talking about it, they jumped in, got their feet wet, and are now ready for the next step. And that next step, hopefully will be a quick and successful transition to a more universal application of this form of Technology-Based Education and Training.

Cost Savings
Early on, DSMC determined that its efforts to institutionalize Technology-Based Education and Training would not be at the expense of quality instruction. The benefits of resident or on-site instruction had to be carefully weighed and evaluated against the advantages/disadvantages of the newcomer.

The trial run and subsequent student surveys showed the College that Technology-Based Education and Training could, indeed serve as another cost-effective method of conveying quality instruction to the acquisition workforce.

What does this mean in the area of cost savings? Consider this. Those 51 students did not have to leave their homes, families, and work sites for resident instruction at another facility, nor did the government incur the cost of sending them on extended TDY for

training. Conversely, DSMC did not have to send the instructor, Dave Schmitz, TDY to San Diego.

Normally, Schmitz would have traveled to San Diego to teach the class on-site, costing the faculty 32 hours of effort — two travel days and two teaching days, to instruct six hours of material. In this case, Schmitz' time to provide six hours of training was approximately 12 hours — six hours of rehearsal and six hours of teaching — saving the College a total of 20 faculty hours of effort.

The math speaks for itself. Technology-Based Education and Training is a "win-win" situation — for the instruc-tor, the students, and lest we forget, the U.S. taxpayer.

Where Do We Go From Here?

DSMC's next opportunity to imple-ment lessons learned from the San Diego trial run, will be its ACQ-201 offering at Patuxent River, Md. Mean-while, the College is exploring options that will facilitate VTT instruction in other subject areas.

As DSMC evaluates VTT, determining what works and what doesn't work, it expects to smooth out any rough edges or bumps along the road. Even-tually, the College hopes to expand VTT's capabilities and deliver not merely isolated classes, but whole courses. Combined with computer-based instruction, the College views VTT as a vitally important, powerful method of delivering critically needed, quality instruction to the acquisition workforce.

ENDNOTES

1. "Strategic Initiative #2 — Imple-ment Distance Learning Techniques," *Defense Systems Management College Corporate Plan*, FY 1997, Part III, p. 20.
2. DAU's *Technology-Based Education and Training Plan*, updated June 5, 1997, may be accessed and printed from **http://www.acq.osd.mil/dau** — DAU's Home Page on the World Wide Web.

YESTERDAY'S STATE-OF-THE-ART C² SYSTEM, TODAY'S SMITHSONIAN ARTIFACT

A terminal once part of the World Wide Military Command and Control (C²) system was added July 16, 1997, to the Smithsonian Institution's historical collection here.

Army Lt. Gen. David J. Kelley, Director of the Defense Information Systems Agency, presented the terminal to officials of the National Museum of American History for inclusion in the armed forces history collection.

The first of its kind, the C² system went on line in 1972 at Strategic Air Command Headquarters, Offutt Air Force Base, Nebraska. It gathered information using an automated data processing network of communications links and satellites. Delivering that information quickly, it improved military leaders' ability to coordinate personnel and intelligence.

The network was first used to plan military and support operations in response to the 1978 mass suicide of the Jim Jones cult in Jonestown, Guyana. It was also used to help plan operations Desert Shield and Desert Storm in 1990-91. The system was replaced last year by the Global Command and Con-trol System.

Editor's Note: Excerpt of a July 16, 1997, Smithsonian Press Release.
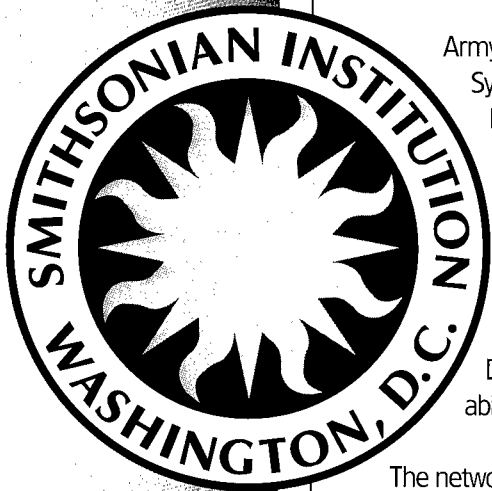
INDUSTRY MANAGERS PARTICIPATE IN FIELD TRIP

A t the conclusion of DSMC's Advanced Program Managers Course (APMC) 97-1, the College offered its industry students — for the most part industry managers from a wide diversity of defense industries — a field trip to visit several military activities. This was a unique opportunity for them to observe first-hand, the operations and support of some of the actual products of the acquisition process. During this year's trip, April 21-25, they visited the National Training Center at Fort Irwin, Calif; the Air Force Flight Test Center at Edwards AFB, Calif; the U.S.S. *Nimitz* in the Pacific Ocean near San Diego; the U.S.S. *Oldendorf* Destroyer and the U.S.S. *Houston* Submarine docked in San Diego, Calif.; and the Third Marine Aircraft Wing at Naval Air Station, Mirimar, Calif. Knowledgeable acquisition professionals at each installation hosted the students, providing briefings on their acquisition processes and specific equipment. As recent APMC graduates, the former students relished the opportunity to observe first-hand the products and processes they had only just recently studied in the classroom.

DSMC's industry students enjoy a unique opportunity in that they would not otherwise be given access to these military installations and to this type of feedback from the user's perspective. By participating in the College-sponsored Industry Managers Field Trip, they were able to cap their education in the new government acquisition policies by gaining first-hand information from the customer's perspective. As one industry graduate of the APMC stated, "It was a fascinating and extremely informative week getting to know the users, and seeing the weapons being exercised in their intended environment."

DR. JAMES PRICE, DEAN, RESEARCH, CONSULTING, AND INFORMATION DIVISION, DSMC, GETS A FIRST-HAND LOOK AT THE AIR FORCE'S F-16 FIGHTING FALCON AT EDWARDS AFB, CALIF.

L/CC Sgt. J. Curry
A/CC Sra. R. White
A/CC A1C. P. Bustamante

Photos by Richard Mattox

FROM LEFT: VINCE GARCIA, MIKE LOMBARD, AND BOB MORRIS, PRATT & WHITNEY STUDENTS, DISCUSS AIR FORCE ENGINE ISSUES WITH A PRATT & WHITNEY REPRESENTATIVE AT THE 412TH PROPULSION FLIGHT COMPONENT REPAIR SQUADRON AT EDWARDS AFB, CALIF.

MECHANICS OF THE 81ST REPAIR COMPANY AT THE NATIONAL TRAINING CENTER, FORT IRWIN, CALIF., DEMONSTRATE THE REPAIRING AND REBUILDING OF AN M-1 ABRAMS TANK TURBINE ENGINE.

APMC 97-1 INDUSTRY STUDENTS GATHER AROUND AN M-1 ABRAMS TANK TO OBSERVE AN AFTER ACTION REVIEW BY MEMBERS OF 4-64 ARMOR GROUP IN THE DESERT AT FORT IRWIN, CALIF.

FROM LEFT: LEON SHIFFLETT, SIKORSKY AIRCRAFT, ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT, AND DENNIS WILL, NORTHROP GRUMMAN, DISCUSS EQUIPMENT AND TACTICS WITH A SOLDIER (SECOND FROM RIGHT) AFTER THE BATTLE IS OVER AT THE NATIONAL TRAINING CENTER.

INDUSTRY MANAGERS PARTICIPATE IN FIELD TRIP

APRIL 21-25, 1997

CARRIER OPERATIONS ABOARD THE U.S.S. *NIMITZ* AT SEA NEAR SAN DIEGO, CALIF.

APMC INDUSTRY STUDENTS RECEIVE A BRIEFING ON F/A-18 OPERATIONS BY MEMBERS OF THE 3RD MARINE AIRCRAFT WING. 1ST ROW, FROM LEFT: MIKE LOMBARD, PRATT & WHITNEY; CRAIG VAN SHILFGAARDE, TRW; BOB NORMANDY, MITRE; DENNIS WILL, NORTHRUP GRUMMAN; BOB MORRIS, PRATT & WHITNEY. 2ND ROW, FROM LEFT: GEORGE KRIKORIAN, DSMC INDUSTRY CHAIR; DEBBIE ALBIOL, THE AUTOMATION GROUP.

A U.S. ARMY LIEUTENANT (SECOND FROM LEFT) SERVES AS GUIDE AND EXPLAINS BATTLE PLANS ON THE DESERT AT FORT IRWIN, CALIF., TO APMC INDUSTRY STUDENTS LOU JOBINS, ROBBINS-GIOIA; VINCE GARCIA, PRATT AND WHITNEY; AND CRAIG VAN SCHILFGAARDE, TRW.

STEVE VANWORMER, THE AEROSPACE COMPANY, PRESENTS THE APMC INDUSTRY STUDENT PLAQUE TO AIR FORCE COL. JIMMIE DOOLITTLE, VICE COMMANDER OF THE AIR FORCE FLIGHT TEST CENTER, IN APPRECIATION FOR HOSTING THEIR VISIT. DOOLITTLE IS GRANDSON TO THE "ORIGINAL" JIMMIE DOOLITTLE, A MEMBER OF THE ARMY AIR CORPS, WHO IN WORLD WAR II LED THE INFAMOUS "DOOLITTLE TOKYO RAIDERS" ON A BOMBING ATTACK AGAINST THE JAPANESE ON DECEMBER 21, 1941, EXACTLY TWO WEEKS TO THE HOUR AFTER NEWS OF THE ATTACK ON PEARL HARBOR REACHED WASHINGTON.

APMC INDUSTRY STUDENTS WERE FLOWN TO THE U.S.S. *Nimitz* DURING SEA OPERATIONS OFF THE COAST OF SOUTHERN CALIFORNIA IN THIS C-2 GREYHOUND AIRCRAFT. SAFE ARRIVAL AT THE NORTH ISLAND NAVAL AIR STATION, AFTER BEING CATAPULTED OFF THE U.S.S. *Nimitz* (ZERO TO 146 MILES PER HOUR IN THREE SECONDS).

LEON SHIFFLETT, SIKORSKY AIRCRAFT, PRESENTS THE APMC INDUSTRY STUDENT PLAQUE TO VICE ADM. BRENT BENNETT, COMNAVAIRPAC, FOR HIS BRIEFING ON THE NATURE AND ROLE OF U.S. NAVY CARRIER AIRCRAFT PRESENCE WORLDWIDE.

DSMC Conducts Successful Ninth International Acquisition/Procurement Seminar With German Federal Academy

Seminar Enjoys Greatest Turnout in its History — 10 Nations, 100 Participants

RICHARD KWATNOSKI

During the week of July 7-11, 1997, the International Defense Educational Arrangement (IDEA) sponsored its Ninth Annual International Acquisition/Procurement Seminar, at the Federal Academy of Defence Administration and Military Technology in Mannheim, Germany. U.S. Army Brig. Gen. General Richard A. Black, the Commandant of DSMC, and Peter J. George, the President of the Federal Academy, provided the official welcome and opening remarks. By all accounts, this was a most successful seminar, with over 100 participants from 10 nations — the greatest turnout for any of the European seminars. Participating nations were the four IDEA

FLAGS OF THE FOUR INTERNATIONAL DEFENSE EDUCATIONAL ARRANGEMENT (IDEA) NATIONS AS WELL AS THE NORTH ATLANTIC TREATY ORGANIZATION (NATO) FLY IN FRONT OF THE FEDERAL ACADEMY OF DEFENCE ADMINISTRATION AND MILITARY TECHNOLOGY, MANNHEIM, GERMANY. FROM LEFT TO RIGHT ARE THE FLAGS OF THE UNITED KINGDOM, FRANCE, UNITED STATES, NATO, AND GERMANY.

THE FEDERAL ACADEMY OF DEFENCE ADMINISTRATION AND MILITARY TECHNOLOGY, MANNHEIM, GERMANY, WAS THE SITE OF THE NINTH ANNUAL INTERNATIONAL ACQUISITION/PROCUREMENT SEMINAR, JULY 7-11, 1997. FEDERAL BUILDINGS IN GERMANY MUST SPEND 10 PERCENT OF CONSTRUCTION COST ON ARTWORK. AN EXAMPLE OF THIS IS PROMINENTLY DISPLAYED ON THE ROOF OF THE FEDERAL ACADEMY.
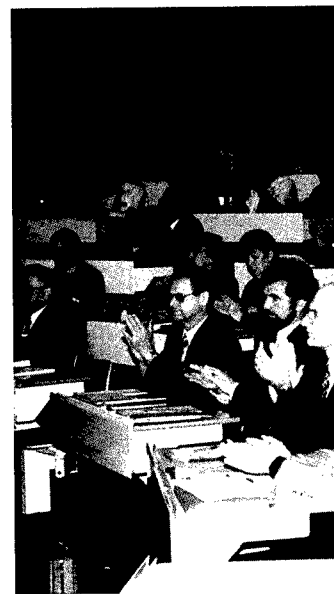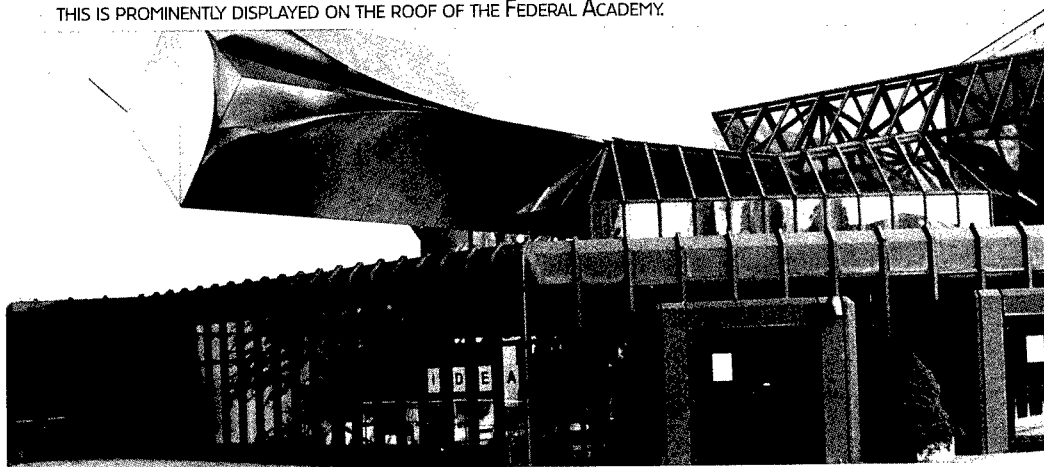
Kwatnoski is the Director, International Acquisition Courses, Executive and International Department, School of Program Management Division, DSMC.

Photos by Ed Boyd

members: Germany, France, the United States, and the United Kingdom; plus Australia, Canada, The Netherlands, and Spain. For the first time ever, Japan and Singapore participated.

German National Presentation

The Seminar opened with a presentation of the comparative acquisition practices of the IDEA nations. Following this were national presentations from the four IDEA member nations. Speaking on "The Arms Market in the Former East Bloc, and Armaments Cooperation with the Members of the Commonwealth of the Independent States and the Central and Eastern European Countries," Ministerialrat Dr. Elmar Rauch delivered the German national presentation. In addition to his national presentation, Rauch speculated on the future of collaboration, specifically concerning development of the Future Large Aircraft.

French National Presentation

Ingenieur en Chef pour l'Armement, Luc Boureau, provided the French national presentation, which focused on the effects of French acquisition reform on planning, acquisition strategy, program management, and organization. He predicted that cooperative activity between France, Germany, the

PETER J. GEORGE (LEFT), PRESIDENT OF THE FEDERAL ACADEMY OF DEFENCE ADMINISTRATION AND MILITARY TECHNOLOGY, MANNHEIM, GERMANY, CONFERS WITH U.S. ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT, PRIOR TO THE START OF THE CONFERENCE.

SEMINAR PARTICIPANTS APPLAUDING ONE OF THE GUEST SPEAKERS DURING THE SEMINAR.

United Kingdom, and possibly the United States should more than double in six years.

U.S. National Presentation

Alfred Volkman, the Assistant Deputy Under Secretary of Defense for Armaments Cooperation in the Office of the Secretary of Defense, International and Commercial Programs, gave the U.S. national presentation. Volkman stressed new initiatives in the United States to stimulate cooperation with allies in acquisition. Lively discussion ensued on the topic of impediments to cooperation as seen from both sides of the Atlantic Ocean.

British National Presentation

Peter Watkins, the British Counselor for Defence Procurement stationed in Bonn, Germany, provided the final national presentation. Watkins covered the Procurement Executive organization, functions, processes, and policies of that centralized procurement activity of the United Kingdom, Ministry of Defence. He noted that cooperation with allies in defence acquisition programs has been the normal way of doing business in the United Kingdom. Watkins went on to say that about 20 percent of British defence acquisition was done cooperatively or procured from allied sources, primarily the United States.

Other Presentations, Workshops

Other topics covered during the week-long Seminar included international project management, cost performance responsibility, and international industrial cooperation. For the first time, a representative of the Australian Defence Forces Academy provided a presentation, and chose to speak on the topic of "Global Defence Trends." Two workshops were conducted during the seminar: one in the cultural aspects of international projects, and the other on metrics for international projects. The last day of the Seminar offered participants a choice between presentations on acquisition/procurement education or foreign comparative testing.

Bonus for U.S. Participants

The annual Seminar features a bonus to the U.S. acquisition workforce participants in providing equivalency to the assignment-specific Multinational Program Management Course (Defense Acquisition University Course PMT 202). For U.S. acquisition personnel in the European Theater, this is a unique, annual opportunity to obtain acquisition training and education along with their allied peers at a level appropriate to their experience, without incurring the significant expense of traveling back to the United States.

1998 - Paris in July

The Tenth Annual Seminar will be held next year during the second week of July, at The Center for High Studies of Armaments (CHEAr), the French acquisition education institution in Paris.

NINTH INTERI
ACQUISITION/

"Cooperation As Seen From B

U.S. ARMY BRIG.
GEN. RICHARD A.
BLACK, DSMC
COMMANDANT
(LEFT) AND PRO-
FESSOR PETER
ROLLER, GERMAN
FEDERAL ACADE-
MY OF DEFENCE
ADMINISTRATION
AND MILITARY
TECHNOLOGY
(RIGHT) WELCOME
COL. RICHTER OF
THE GERMAN
LUFTWAFFE, INTER-
NATIONAL PROJECT
MANAGEMENT
PRESENTER.

DSMC SEMINAR DIREC-
TOR RICHARD KWATNOSKI
(RIGHT FOREFRONT)
ENJOYS A TYPICAL GER-
MAN TROOP MEAL WITH
SEMINAR PARTICIPANTS AT
THE FEDERAL ACADEMY
CAFETERIA.

Dr. Markows

Photos by Ed Boyd

ATIONAL
PROCUREMENT SEMINAR

h Sides of the Atlantic Ocean"

DR. STEPHEN MARKOWSKI
(FROM THE AUSTRALIAN
DEFENCE FORCE ACADEMY,
CANBERRA, AUSTRALIA) PRE-
SENTS HIS PAPER ON "GLOBAL
TRENDS IN DEFENCE PROCURE-
MENT". DR. MARKOWSKI IS THE
FIRST PRESENTER FROM AUS-
TRALIA AT AN IDEA SEMINAR.
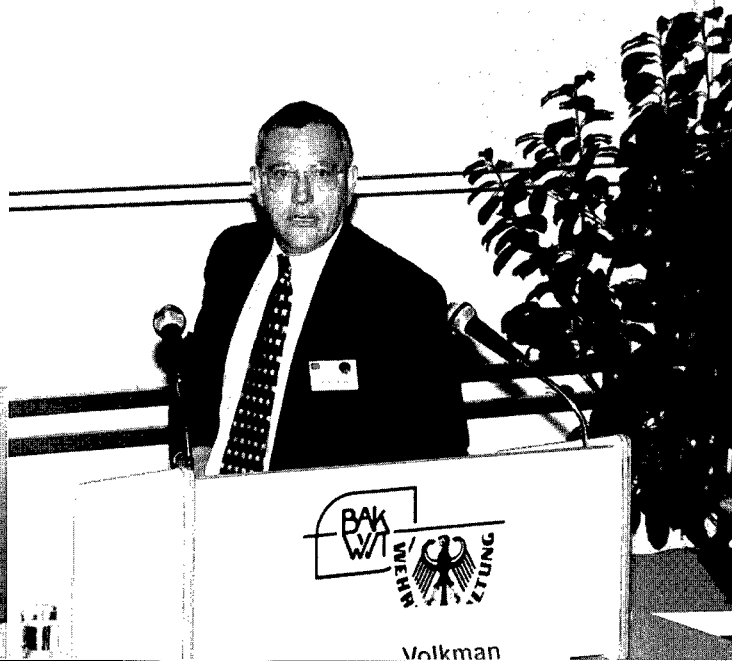
ALFRED G. VOLK-
MAN, PRINCIPAL
DIRECTOR, INTER-
NATIONAL ARMA-
MENTS COOPERA-
TION, OFFICE OF
THE SECRETARY OF
DEFENSE, FIELDS A
DIFFICULT QUES-
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CLUSION OF THE
U.S. NATIONAL
PRESENTATION.

SEMINAR PARTICIPANTS FROM THE UNITED STATES
AND SINGAPORE CONFER DURING A BREAK.

Western Region Picks Up Where Central Region Leaves Off

Restructuring, Innovative Teaching Strategies, Facilities Upgrade at DSMC's Western Region

ROBERT L. TATE

Located in beautiful, sunny Southern California, the Defense Systems Management College (DSMC) Western Regional Center (WRC) is located on Los Angeles Air Force Base, about three miles from Los Angeles International Airport. Also situated on the base is the Air Force Space and Missile Systems Center (SMC), where many of the Air Force's newest acquisition programs are currently being started. In close proximity is the Defense Contract Management Command's (DCMC) Western Region Headquarters. Together, their missions require acquisition and program management skills that traverse all levels and categories of the acquisition disciplines. As a result, SMC and DCMC are a rich source of potential students for the WRC.

ROBERT TATE, DIRECTOR, WESTERN REGION (RIGHT) DISCUSSES THE WESTERN REGION'S PENDING MOVE TO ANOTHER AIR FORCE BUILDING WITH DSMC COMMANDANT, ARMY BRIG. GEN. RICHARD A. BLACK. ALSO JOINING THE DISCUSSION IS LISA GEORGE (LEFT), THE DSMC WESTERN REGION'S MANAGEMENT SUPPORT ASSISTANT.

A Brief History

Recently, the DSMC WRC Director, Robert Tate, hosted Army Brig. Gen. Richard A. Black, DSMC Commandant; and DSMC Air Force Chair, Anthony "Tony" Kausal, during Black's first visit to both activities. The WRC visit was part of Black's oversight tour of several West Coast Defense Acquisition University (DAU) consortium schools.

Prior to closing the DSMC Central Regional Center and establishing a new DSMC Mid-Atlantic Regional Center, the DSMC Central and West-ern Regional Centers shared the area west of the Mississippi River. The approximate dividing line created the DSMC WRC, which included the Mountain and Pacific Coast states as well as the two OCONUS states of Alaska and Hawaii.

Since closing the DSMC Central Regional Center in St. Louis, the DSMC WRC now covers a much larger geographical area. Within the area are located four of the five Air Force Materiel Command Depots ó McClellan, Hill, Tinker, and Kelly.

Several vast test ranges, maneuver areas, and complexes fall within WRC's geographical boundaries: White Sands; China Lake and Point Mugu; Edwards; Tonopah; Nellis; the National Test Range at Fort Irwin; Yuma Proving Ground; Fort Huachuca; Marine Corps Camp Pendelton and 29 Palms; and two Warfare Centers – Space and Tactical Warfare. In addition to these areas, Vandenberg AFB is the launch area for all polar orbiting satellites and all missile intercept test activity; and Kirtland is the home for laboratories as well as the

Tate is currently the Director, Western Regional Center, DSMC, Los Angeles AFB, Calif., a position he assumed in January 1995. Prior to that, he served as a professor of engineering, functional manager, and course director at the DSMC main Fort Belvoir, Va., campus from June 1984 to January 1994. Tate holds a B.S. in Electrical Engineering from San Diego State College and an M.S. from Central Michigan University. He is also a graduate of the University of California Executive Program.

DSMC WESTERN REGION'S FUTURE HOME WILL EVENTUALLY BE A NEW ACQUISITION EDUCATION CENTER WHERE THE REGION WILL BE THE LEAD TENANT. STANDING IN FRONT OF THE NEW BUILDING ARE FROM LEFT: EDWARD SALEM, DIRECTOR OF STRATEGIC PLANNING, SMC; ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT; TONY KAUSAL, AIR FORCE CHAIR, DSMC EXECUTIVE INSTITUTE; AND ROBERT TATE, DSMC WESTERN REGION DIRECTOR.

airborne laser project and other space test activities.

Nothing So Constant as Change

In addition to these installations and their ongoing activities, change resulting from the Base Realignment and Closure decisions is a reliable constant. Within the WRC, two major shipyards closed — Mare Island and Long Beach; two Air Force Depots, McClellan and Kelly, are in the process of privatization; the Navy Aircraft Repair Facility at Alameda closed; and the Navy is relocating its Space and Naval Warfare Command Headquarters from the nation's Capitol area to San Diego. This Headquarters move either augments or upgrades a local acquisition workforce, which results in additional Defense Acquisition Workforce Improvement Act (DAWIA) education requirements.

THE AIR FORCE SPACE AND MISSILE SYSTEMS CENTER (SMC) AT LOS ANGELES AFB, CALIF., HOSTED THE DSMC COMMANDANT AND AIR FORCE CHAIR DURING A VISIT TO THE DSMC WESTERN REGION. SMC IS WHERE MANY OF THE AIR FORCE'S NEWEST ACQUISITION PROGRAMS ARE CURRENTLY BEING STARTED. PICTURED ARE STAFF AND FACULTY FROM SMC, DSMC, AND THE WESTERN REGION. FROM LEFT: TONY KAUSAL, AIR FORCE CHAIR, DSMC EXECUTIVE INSTITUTE; AIR FORCE COL. MICHAEL KAYE, CHIEF OF ACQUISITION DEVELOPMENT, SMC; LESLIE BORDELON, DIRECTOR OF SYSTEMS ACQUISITION, SMC; ARMY BRIG. GEN. RICHARD A. BLACK, DSMC COMMANDANT; JANET HODGES, WESTERN REGIONAL OFFICE MANAGER, DTIC; DALAL ESTRADA, APDP AND TRAINING MANAGER; AIR FORCE LT. COL. JAMES A. REGO, JR., DEPUTY CHIEF, PROGRAM OPERATIONS, LAUNCH PROGRAMS SPO, SMC; EDWARD SALEM, DIRECTOR OF STRATEGIC PLANNING, SMC; AND ROBERT TATE, DIRECTOR, DSMC WESTERN REGION.

All of these organizations and changes impact the Acquisition workforce either directly or indirectly — some by staying and some by going — and almost always generate out-of-cycle requirements. With the closing of Mare Island, the WRC received a large influx of ACAT I and II acquisition students en route to their new duty locations — most to headquarters' positions. New staffing requirements at the Marine Corps Tactical Systems Support Activity increased their out-of-cycle requirements.

Curriculum, Resources, Teaching Strategy

The DSMC WRC currently conducts only mandatory DAWIA courses, focusing on Acquisition 101 and 201 as well as other selected courses, including some test and evaluation courses and a few mandatory business courses. WRC conducts most of these courses in its large classroom facility, augmented by other local classrooms when scheduling dictates two simultaneous offerings. However, courses are also conducted at the client's on-site location.

Students attending courses at the WRC can participate in extra-curricular activities, access the online Acquisition Deskbook and various other acquisition websites, view some of the DSMC faculty tapes, and use other resources. These resources are not available to students attending courses at local, on-site locations.

During the DSMC Commandant's visit, he and the WRC Director discussed various alternative teaching methods such as distance learning [Technology-Based Education and Training], as a means to implement on-site training away from the WRC without significantly reducing the quality of instruction and extra support that enhances acquisition education.

Branching Out

For some time now, the WRC Director and the DSMC Commandant have collaborated to establish tributary or dis-

trict locations throughout the WRC to establish a presence, forward course material, hand out current items like the *Program Manager* magazine and the CD-ROM Acquisition Deskbook, and augment student material with a permanent reference collection. The DSMC Commandant and WRC Director are in agreement that knowing and working with local points of contact will help to smooth the way for classroom set-up and more effective and efficient course delivery.

With the large segment of the acquisition workforce population located, or soon to be located within the geographical boundaries of the Western Region, DSMC and the WRC are looking at five tentative candidate locations for establishing these small tributary or district locations. Together, they intend to carry out their joint vision of taking a quality education directly to the professional acquisition workforce.

As the first location, they selected San Diego, now home to the relocated Space and Naval Warfare Systems Command (SPAWAR). SPAWAR brought to San Diego an influx of headquarters personnel and their training requirements — requirements that the WRC had not factored into prior planning activities. Since the DSMC Commandant's visit, the WRC conducted an ACQ 201 Intermediate Systems Acquisition Course in the San Diego area, using a rented classroom. However, effort is underway to attain a classroom and small office to serve this new activity.

Other tentative locations for a similar small office with a suitable classroom include Fort Huachuca, Kirtland AFB, Hill AFB, and the China Lake/Edwards AFB high desert area. All of these areas host not only a substantial number of professional acquisition workforce members, but also require unique types of training.

Also during his visit, the DSMC Commandant visited SMC Headquarters, including a courtesy call with the SMC Technical Director, followed by the

SMC Command Briefing. During the visit, discussions were also held concerning WRC's pending move to another Air Force building. This new location will eventually be a new Acquisition Education Center where DSMC will be the lead tenant. The new location provides more classroom, office, storage, and study space. Moreover, the addition of study space will permit DSMC to offer not only the traditional classes, but new, enhanced Technology-Based Education and Training-oriented courses, including computer-based CD-ROM courses and Internet-connected courses. A reading room equipped for hard copy as well as electronic dissemination will provide students the latest acquisition information. Also included will be a viewing room for the latest acquisition and management thoughts and ideas presented by various DoD and other speakers on videotape or other multimedia.

The WRC's vision is simply to reinforce the DSMC vision — "...to be the academy of distinction, promoting systems management excellence." Taking that one step further, WRC is working actively to not only support the DSMC vision, but to also become the focal point and recognized forum for the latest acquisition and systems management thoughts and ideas throughout the entire Western Region.

Inquiries

Anyone who desires to take a course offered by DSMC should first contact their local training office for detailed Service/Component/organization procedures on how to apply for DSMC courses. The Service/Component-level points of contact listed in the DSMC 1997 Catalog (pp. 36-37) can advise on specific application procedures. For catalog requests or general information about DSMC courses, schedules, etc., call the Office of the DSMC Registrar at (703) 805-3681, DSN 655-3681, or Toll Free 1-888-284-4906. Information about DSMC courses, schedules, etc., is also available at http://www.dsmc.dsm.mil on the DSMC Home Page.

DATES   **TOPICS**

October 15, 1997	FAR Part 15
October 23, 1997	Market Research
October 29, 1997	Performance Based Service Contracting (PBSC)
November 5, 1997	Cost As an Independent Variable (CAIV)
November 20, 1997	Earned Value Management (EVM)
January 28, 1998	FAR Part 15 (Review)
February 3, 1998	Oral Presentations
February 11, 1998	Past Performance in Source Selection
May 6, 1998	Information Technology Contracting (ITK)
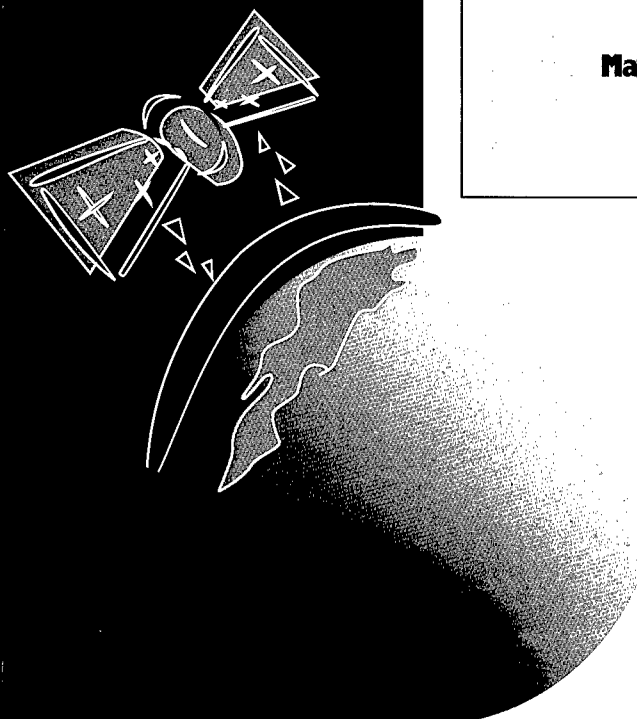
The Defense Acquisition University's Home Page on the World Wide Web offers further information on Acquisition Reform Satellite Broadcasts Access **http://www.acq.osd.mil/dau/arcc/** *for the title of each broadcast, time, frequency, description, technical specifications, broadcast support document, and broadcast evaluation document. Users can also call the Acquisition Reform Communications Center for the latest information on Acquisition Reform Satellite Broadcasts:* **1-888-747-ARCC (Toll free).**

Front End Work Pays Off for Defense Medical Logistics Standard Support (DMLSS) Program

DMLSS Automated Information System (AIS) Will Replace Service Legacy Systems

COL. JOHN CLARKE, U.S. ARMY • JOHN SAIKOWSKI

Underlying principles of program management apply equally to weapon systems and automated information systems (AIS). Simply stated, program managers for both weapon systems and AISs manage cost, schedule, and technical performance. The Department formally acknowledges this common approach to program management in DoDD 5000.1, *Defense Acquisition*, and its accompanying regulation, DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAP) and Major Automated Information System (MAIS) Acquisition Programs*.

System development, whether it be a weapon system or an AIS, is one possible response to a mission deficiency. A new start implies that the decision-making authority recognizes the need to eliminate a mission deficiency and is willing to obligate the funds for that purpose. For a weapon system, a mission need statement (MNS) will cite a threat that can not be eliminated through changes in tactics, a non-materiel solution, or even an upgrade to an existing system. An AIS MNS, on the other hand, may have little to say about threat. More likely, it will identify a need for improving efficiency by automating reengineered business processes.

Why develop a new AIS? AIS development begins because there is a bona fide need for an AIS, and return on investment (ROI) estimates support a new start decision. If an investment of $1 in an AIS will produce $2, $3, $4 or more in benefits, that level of ROI is reason enough to consider the investment. Without an acceptable ROI, support for a new AIS may be difficult to obtain.

A lot may be said about the similarities of weapon system and AIS program management, but that is not the intent here. This is simply a brief article on the successes achieved to date by one ACAT IAM program, the Defense Medical Logistics Standard Support (DMLSS) Program.

The DMLSS Program, which has earned a 6.5:1 ROI for the period FY 91 to FY 96, is similar in complexity to many weapon systems. It encompasses business process reengineering of medical logistics functions at the wholesale (depot) and retail (medical treatment facility or MTF) level, and system development activities needed to support reengineered business processes (Figure 1).

Currently, a number of software applications and systems are being devel-

oped as part of the DMLSS Program. The one major AIS being developed is logically called the DMLSS AIS.

DMLSS will be used in peace and war, in fixed and transportable facilities, and consists of three main modules:

- Materiel Management (MM)

- Facility Management (FM)

- Equipment and Technology Management (E&TM)

Both MM and FM have multiple increments.

The DMLSS AIS will replace eight Service and one DoD aging legacy medical logistics systems, including the Air Force's Medical Logistics System and the Army's Theater Army Medical Management Information System. The DMLSS Program is co-sponsored by the Assistant Secretary of Defense (Health Affairs) and the Deputy Under Secretary of Defense (Logistics).

The DMLSS MNS, approved in 1993, cited the following major deficiencies in the Department's medical logistics operations:

- Excessive inventories of medical

Clarke is the Defense Medical Logistics Standard Support (DMLSS) Program Manager, and is a 1996 graduate of the Executive Program Managers Course, DSMC. Saikowski is a manager with Electronic Data Systems (EDS) Corporation and is a graduate of PMC 84-1, DSMC. He is a charter member of the DSMC Alumni Association and served on the Board of Directors from 1990 to 1995.
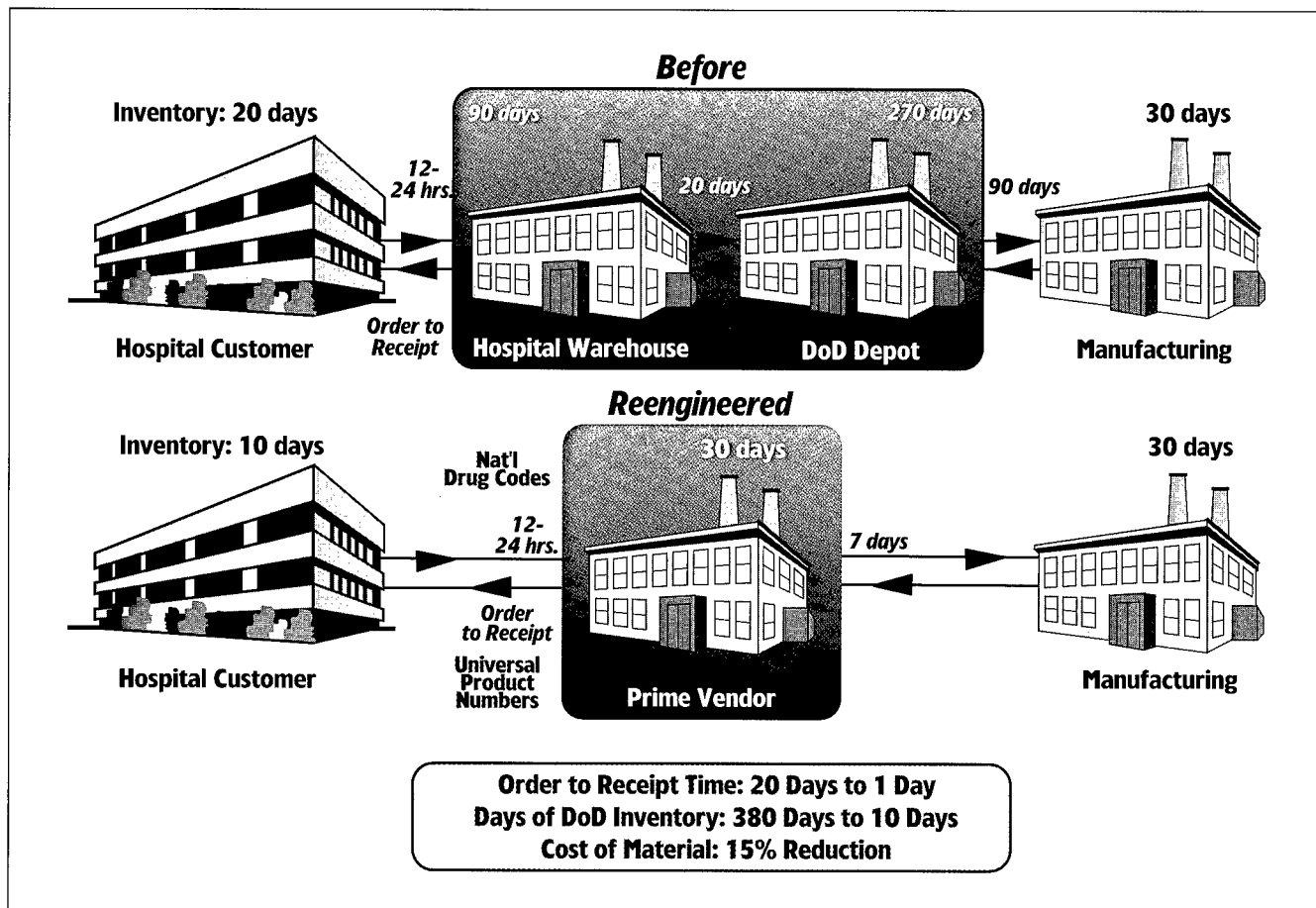
Figure 1. **DMLSS Reengineered Peacetime Business Practice**

items at the wholesale and retail levels.

• Excessive prices paid for pharmaceutical and medical/surgical items.

• Excessive time spent by MTF clinical staff on ordering and receiving supplies and equipment, and accounting for property.

• The need for an enhanced medical readiness capability to support wartime/contingency operations.

The Department's medical logisticians realized early on that correcting deficiencies noted in the MNS would involve medical logistics process reengineering and AIS development. Emphasis on consolidating and reducing the number of legacy systems being supported at MTFs throughout the Department provided the appropriate backing for a new AIS. This new AIS would support the reengineered

business processes, provide a common system for use by all the Services, and permit legacy system shutdown.

Developing a new major AIS would take time. As a result, medical logisticians asked themselves what business process changes could be implemented in the near term that would provide fast payback on an investment. The answer was Prime Vendor Pharmaceutical and Prime Vendor Medical/Surgical.

Under the Prime Vendor fast payback initiative, the Defense Personnel Support Center (DPSC) negotiated distribution and pricing agreements with manufacturers, and Prime Vendor contracts with distributors. Electronic commerce/electronic data interchange (EC/EDI) is at the core of these contracts and agreements. EC/EDI permits direct electronic ordering of drugs and medical/surgical items by MTFs from Prime Vendors. The results are —

• substantial reduction in prices;

• overnight direct delivery;

• 95-percent demand satisfaction; and

• elimination of large inventories in Defense depots and MTFs.

For the period FY 91-FY 96, DPSC reduced its wholesale inventories of medical items by $404 million, and the cost of drugs to the Department by $154 million. During this same period, MTFs decreased their inventories by $84 million. An automated product and price comparison tool, first introduced as part of the automation piece of Prime Vendor, facilitated the drug cost reduction. Currently, this tool is being enhanced in the DMLSS AIS. For every drug purchase, it permits quick and easy identification of the least-expensive, generically equivalent, acceptable drug. There simply is no
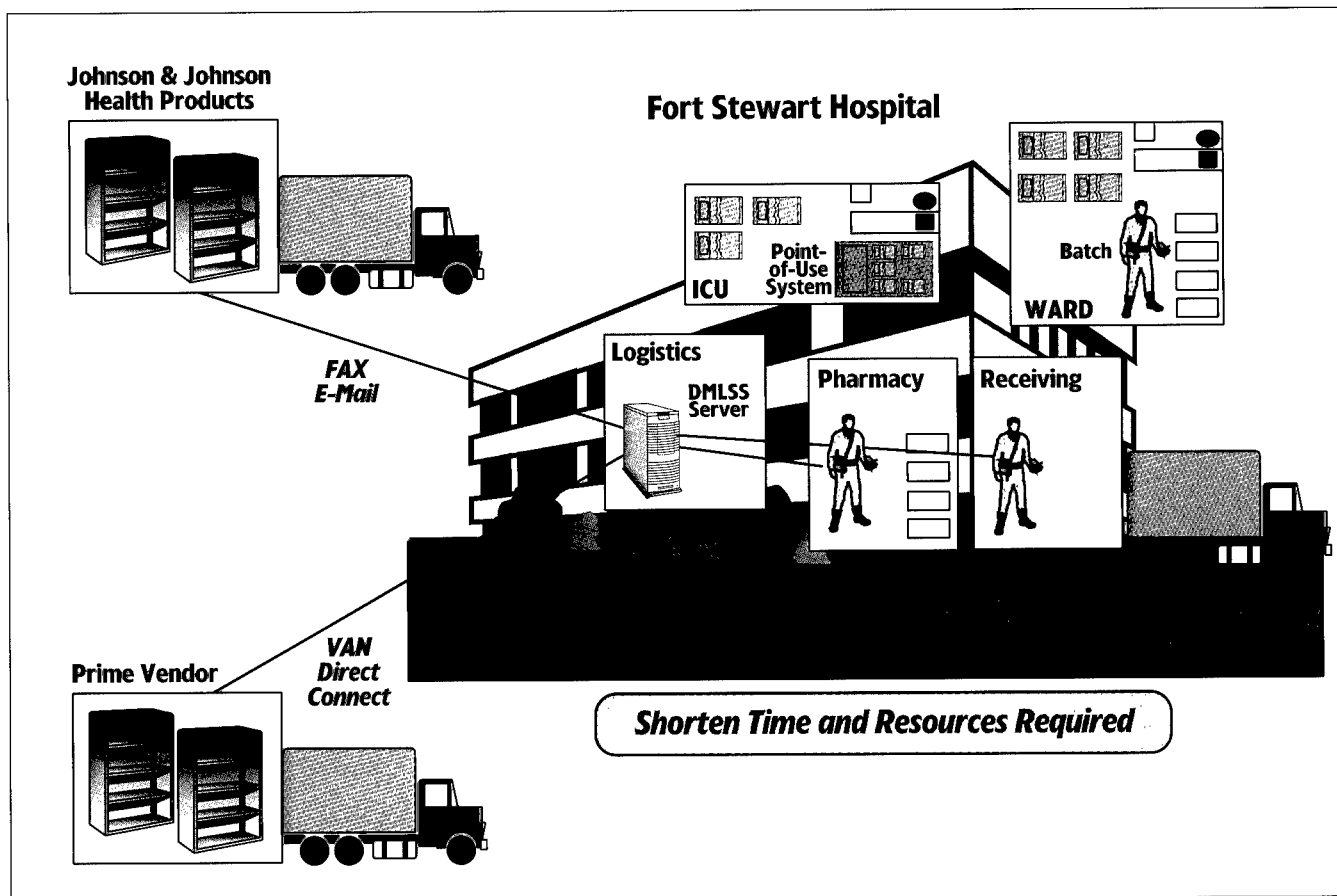
Figure 2. **DMLSS Release 2.0 — Customer Area Inventory Management**

reason for an MTF to place orders for any drug or medical/surgical item that is not the least-expensive, acceptable item.

The DMLSS AIS is being developed in three major releases. Release 1.0, contains an FM and Forward Customer Support (FCS) capability. FCS contains product and price comparison tools introduced to MTFs originally as part of Prime Vendor. FM automates critical facility management functions heretofore done manually. In May 1997, DMLSS Release 1.0 was deployed to 68 MTFs. This release is continuing to be deployed to five or six additional sites each month.

DMLSS Release 2.0, targeted for release to the first test site in January 1998, contains the Customer Area Inventory Management (CAIM) module and the second increment of FM (Figure 2). CAIM uses hand-held, wireless, bar code technology to con-

trol receipts and inventories. A streamlined interface with the Defense Finance and Accounting Service (DFAS) and streamlined EC/EDI procedures between MTFs and Prime Vendors are also being designed into this release. The streamlined DFAS interface will simplify financial transactions between medical logistics systems and DFAS by a factor of 98 percent, by adopting a minimum set of standard data items and transactions and instituting bulk invoice payment procedures. The DFAS streamlining initiative is a classic illustration of concurrent business process reengineering and system development. DMLSS Release 2.0 is targeted for deployment in the summer of 1998.

Targeted for deployment in July 1999, the final DMLSS release, Release 3.0, contains Stock Room Inventory Management (SRIM) and E&TM capabilities.

DMLSS has not forgotten about deployed forces. In addition to tailor-

ing the DMLSS AIS for field use, DMLSS is a principal player in developing the commercial asset visibility (CAV) and joint total asset visibility (JTAV) concept. With the drastic reduction of wholesale inventories of medical items, CAV/JTAV will ensure that deployed forces are properly supported with medical items.

The DMLSS Program happened at the right time. Streamlining initiatives that are the mainstay of DMLSS would not have been possible 10 years ago. Today, with Government reinvention identified as one of DoD's top priorities, the sky is the limit. Not only is "thinking outside the box" accepted, but our senior DoD acquisition leadership now encourages program managers to do the things that make sense for their programs.

The beneficiaries are many. Hospitals can manage more efficiently through reduced operating costs and provide better patient care. There are no losers!

The Kaminski Initiative

Our Most Significant Piece of Unfinished Business in Reforming the Defense Acquisition Process

DANIEL P. CZELUSNIAK • PHILIP D. RODGERS

Greek mythology relates the story of Sisyphus, son of Aeolus (the king of Thessaly) and founder of Corinth, who was infamous for betraying the secrets of the gods. It's said that Sisyphus saw Zeus carry off the beautiful maiden Aegina to the island of Attica (in the Sardonic Gulf) where she later gave birth to a son, called Aeacus, who eventually became monarch of the island. When Sisyphus revealed what he had witnessed to Aegina's father (the river god Asophus), Zeus became so enraged he called on Hades (lord of the dead and ruler of the nether world) to intervene and punish Sisyphus.

In the realm of the dead, Sisyphus was compelled to roll up a steep hill, a large stone, which immediately tumbled back down when he reached the top. He was condemned to repeat the process for eternity. His punishment was, and is today, depicted on many Greek vases as a naked man pushing a boulder.

This is not unlike the condemnation program managers have to endure as they struggle to roll the "stone" of program cost reduction up the "hill" of seemingly endless "taxes" and funding cuts that force continuous program restructuring. Even though we have made significant progress reforming the defense acquisition process in the past few years, resulting in reduced costs and other efficiencies, we are still losing ground to the problem of cost growth due to the lack of program stability (Figure 1). This is not a new problem. Virtually every major study of the defense acquisition process in the last two decades has identified the lack of program stability as a key ingredient in the high cost of defense systems.

> **Even though we have made significant progress reforming the defense acquisition process in the past few years, resulting in reduced costs and other efficiencies, we are still losing ground to the problem of cost growth due to the lack of program stability.**
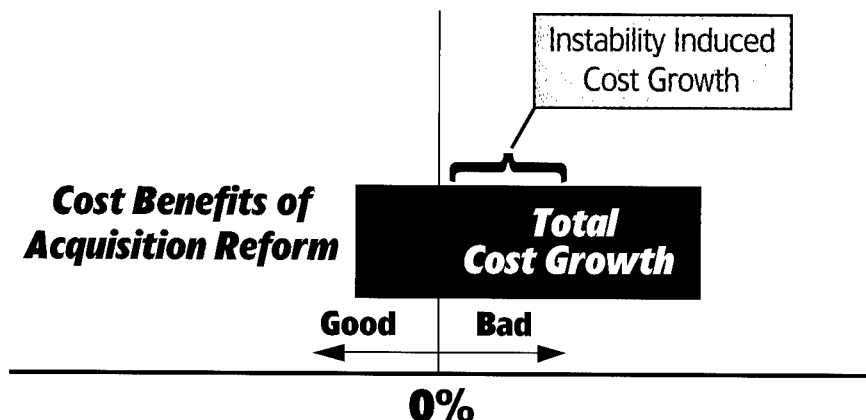
Figure 1. **Benefits of Reform Pale in Comparison to Cost Growth from Instability**

Czelusniak is the Director, Acquisition Program Integration, Office of the Under Secretary of Defense for Acquisition and Technology. Rodgers is a senior operations research analyst on the staff of the Office of the Under Secretary of Defense for Acquisition and Technology. A former Naval officer, Rodgers' career experience includes a variety of positions dealing with long-range planning and programming, weapon system cost analysis, and personnel planning. He holds a B.S. in Biology from the University of Illinois and an M.S. in Operations Research Analysis from the Naval Post Graduate School. Rodgers was co-chairperson of the Acquisition Program Stability Task Force in the Quadrennial Defense Review.

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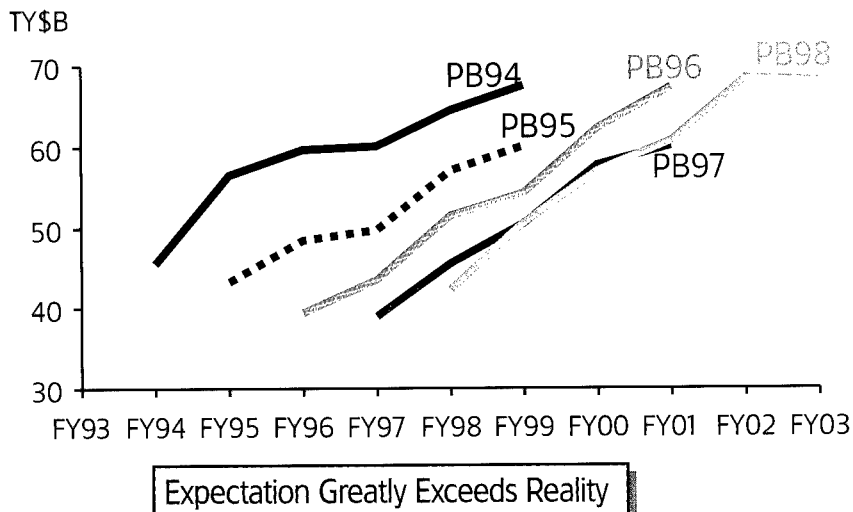
Figure 2. **The Credibility Problem: DoD Procurement Funding — President's Budget Projections**

Perspective, Implications, and the Quadrennial Defense Review

Historically, in comparison to estimates at Milestone II, major weapon systems have experienced approximately 25-percent cost growth at program completion. The root causes of this growth are difficult to precisely quantify, but internal programmatic factors such as simple underestimation, unanticipated technical problems, and requirements changes due to changing threats are certainly recognized contributors. However, the predominant cause can be traced to the heart of the program stability issue.

It has been estimated that as much as half of the cost growth in major weapons systems is due to nothing more than funding instability. That is,

the reallocation of funding to other near-term priorities external to a program. These kinds of repeated funding excisions ultimately lead to sizable program cost growth. This is growth which contributes no added value whatsoever to the system being developed/produced.

One analysis estimated that the Department of Defense loses approximately $5 billion per year in investment program content due to cost growth. In real terms, this represents the value of material we were unable to acquire for our warfighters. Without a fundamental altering of resource management practices within the Department to confront this problem, these losses should be expected to continue.

The specter of a perpetual drain on investment accounts was what led Dr. Paul G. Kaminski to adopt "program stability" as his number one, near-term acquisition reform priority, and why he considered it the most significant piece of unfinished business in his recently concluded tenure as the Under Secretary of Defense for Acquisition and Technology. Viewed at the macro level, funding instability is an endemic Department problem as documented by a retrospective look at recent Future Year Defense Plans (FYDP) (Figure 2). Despite repeatedly forecasting sizable increases in future procurement budgets, we have consistently failed to realize those expectations.

This has produced the so-called "advancing trough" in procurement funding (Figure 3). The trend over the past several years has been for the trough to shift to the right each year as the Department postpones the long-awaited modernization and recapitalization of our armed forces. As disruptive as this trend has been to individual program execution, its existence has created an even more disturbing credibility gap with the public and our elected officials in the Congress. Our promises of increased funding for procurement in a fiscally constrained environment simply do not ring true.

When the Quadrennial Defense Review (QDR) was launched several months ago, there was a heavy emphasis on a national defense strategy, force structure requirements to meet that strategy, and the proper mix of systems for our armed forces. An important objective of the QDR was reducing costs in the support structure to free up resources which could be applied to increase funding available for investment. However, it was also recognized that the QDR provided an opportunity to confront, even in an environment of reduced budgets, the long-standing problem of funding instability. To ensure this specific issue was comprehensively addressed, a special task force was chartered to define

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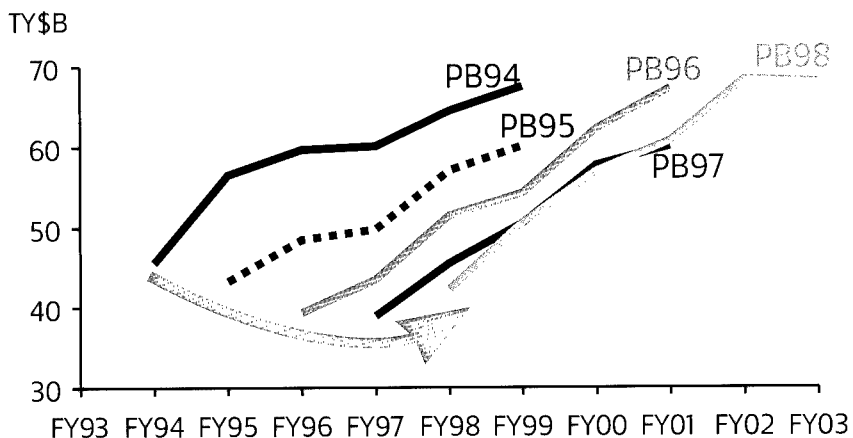
Figure 3. **The Procurement Trough**

Clinton Era Budgets
Average Dollar Change From POM Baseline
2 Cycles Prior to Execution
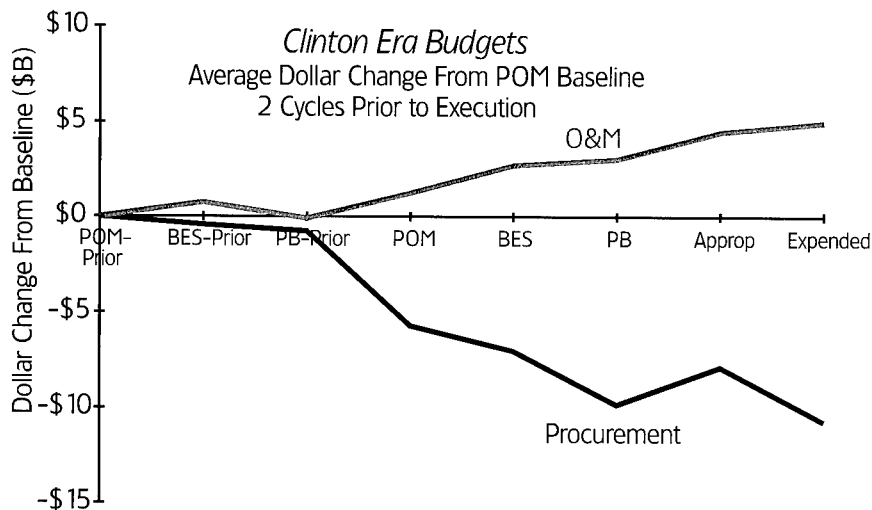
Figure 4. **The Overall Migration Problem: DoD O&M and Procurement Planning vs. Outcome**

the problem, identify the basic causes, and outline reasonable measures to alleviate the problem.

Budgetary Uncertainty and Practical Limitations

Funding instability is largely a manifestation of the uncertainty and limitations built into our current planning process. In order to manage the defense enterprise, we develop plans and budgets for programs several years in advance of actually receiving an appropriation from the Congress. As a result, the FYDP is predicated on tenuous assumptions of stable forecasts for total obligational authority over time, and consistent priorities for national security and operational commitments of our forces. In addition, defense weapon systems are on the leading edge of technology, making it difficult to forecast with absolute certainty what risks new technological advancements entail, and the impact those risks might have on the systems being acquired.

When any of the basic parameters (i.e., obligational authority, priorities, or technological risk) vary from expectations, thus adversely affecting one program, instability can be (and usually is) introduced in other programs in order to accommodate the adverse effect. As a result, "innocent" programs suffer, often enduring signifi-

cant restructuring of painstakingly detailed programmatic planning to offset the induced instability, on the altar of affordability. A recent analysis of the F-22 program showed that these types of restructuring have a 3:1 payback cost. That is, for every dollar taken from the program for short-term affordability reasons, the total cost of the program increased by $3.

The problem is exacerbated by an implied policy that limits explicit programming and budgeting for reserves which could "buffer" programs from these destabilizing effects. The pragmatic concern associated with the vulnerability of reserves to reduction by individuals (at all strata of the Federal Government) charged with balancing budgets, and the question of whether such reserves might actually negatively influence the "natural" pressure to continually seek effective cost-reduction measures, are valid issues which form the foundation of resistance to reserves as a simplistic, wholesale solution to the instability problem.

Migration = Funding Instability

Funding instability is created when fiscal resources migrate from previously planned levels which have been programmed or budgeted for program execution. Understanding the character of the migration is therefore key to identifying a solution(s) to the funding

It has been estimated that as much as half of the cost growth in major weapons systems is due to nothing more than funding instability.

DANIEL P. CZELUSNIAK, DIRECTOR, ACQUISITION PROGRAM INTEGRATION, OUSD(A&T), BRIEFED THE SUBJECT OF PROGRAM STABILITY AT THE 5TH SEMIANNUAL PEO/SYSCOM COMMANDERS/PM CONFERENCE, HOSTED BY DSMC AT ITS MAIN FORT BELVOIR, VA., CAMPUS, APRIL 22-23, 1997.

- O&M Continues to Consume Larger Percentage of TOA
- Current Projections Appear Optimistic — If Assumed Savings Don't Materialize...
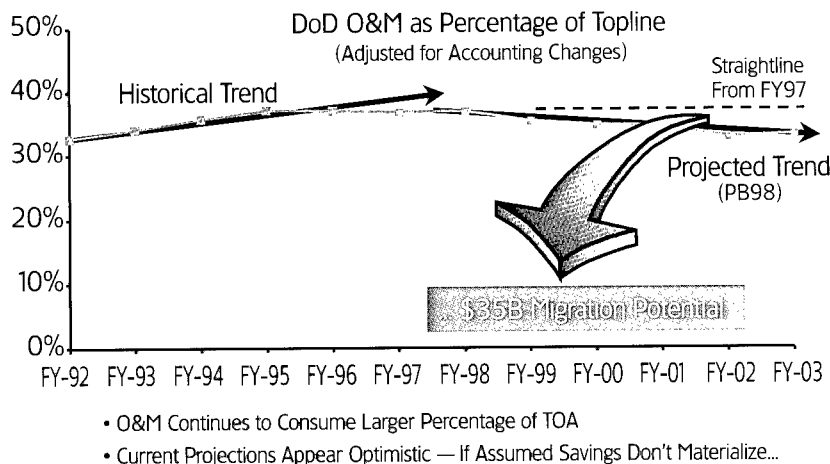
Figure 5. **Future Migration Risk**

instability problem. Clearly, migration of funds from one (lower-priority) investment program to another to solve problems of cost growth generated from within the higher-priority program, is one characteristic pattern contributing to instability.

However, the primary source of funding instability finds itself in the migration of funds from long-range modernization requirements to near-term operating and support (O&S) requirements during the process of building and executing the budget. This is a recurring pattern and is due, in part, to the complexities (e.g., working capital fund accounts) and unknowns (e.g., operational contingencies, priority changes, etc.) present in forecasting O&S requirements. Inaccurate forecasts almost always result in higher-than-anticipated costs.

A significant portion of the migration to O&S requirements is due to unrealized

projected savings and assumed efficiencies related to infrastructure and/or process improvements. The savings projected from closing bases and facilities through the Base Realignment and Closure process are a good example. Because the closure costs have proven to be higher than originally anticipated, the savings have accrued at a much slower rate. Our experience is replete with similar examples of optimistic O&S savings projections, unfulfilled.

Another factor contributing to the migration problem is the fact that the desire for increased modernization, and our ability to definitively quantify and defend those needs, lead to high (some might argue unrealistic) expectations of out-year resources available for investment. But in a resource-constrained environment, these increased out-year expectations put pressure on the O&S accounts and cause an artificially induced depression of the O&S requirements (which we usually cannot

quantify or defend as well as the modernization requirements) in the out-years.

To the extent O&S costs eventually turn out to be higher than anticipated, for any of the reasons noted above, we typically "pay the bill" by deferring quantity procurements and/or extending schedules in investment programs. This, in turn, drives up the cost of those programs and encumbers out-year resources previously planned for other efforts. This counterproductive cycle (i.e., over-programming investment and under-programming O&S) is repeated with amazing consistency, year after year.

The persistence and size of the migration from investment to O&S requirements in every phase of the planning, programming, and budgeting process is illustrated in Figure 4. The change from a baseline established as the funding level in the first out-year of the FYDP when the Components develop their Program Objectives Memoranda (POM) is depicted. That funding level is tracked over a two-year cycle to the Congressional appropriations and through the execution year. Each of the Clinton-era budgets is averaged to provide a composite picture of the migration patterns.

Current planning continues to reflect a high degree of expectation for reductions in Operations and Maintenance (O&M) funding within O&S accounts. Figure 5 is a plot of O&M funding as a percentage of the defense budget top line. Historically, after being adjusted for various accounting changes over time, an increasing percentage of resources has been devoted to O&M. Yet, we are projecting a trend that is actually expected to invert itself based on the assumptions of the President's FY 98 budget request to Congress.

An optimist might view this as a good news story in that we are aggressively pursuing substantial reductions in O&S costs. However, a skeptic could conclude that we would be doing well just to stabilize this trend at the FY 97
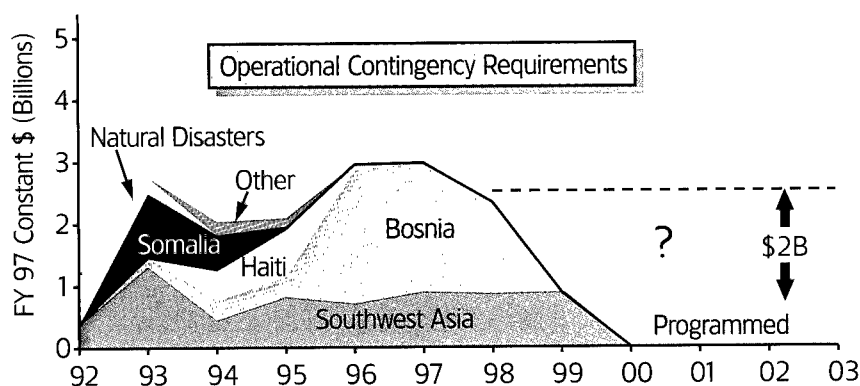
Figure 6. **The Operational Contingencies Problem**
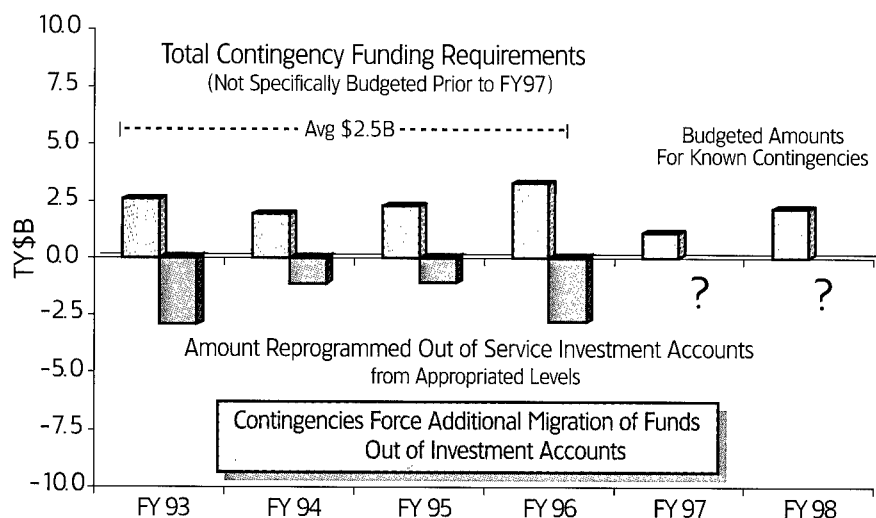
Figure 7. **Investment Programs Pay Contingency Bills During the Year of Execution**

level, let alone reverse it, thus pointing to a potential migration risk of approximately $35 billion over the FYDP period. The importance (to the stability of our investment programs and the ultimate achievement of our force modernization plans) of being able to achieve these O&S reductions should be evident.

QDR Results and Direction

In recognition of the pattern of migration evident from investment accounts in the past, the principal resource management objectives of the QDR were to understand financial risk in the Department's program plans and devise approaches to manage that risk. The analyses conducted to identify principal sources of migration and determine the implications for future requirements framed the context for making decisions in the QDR. Task force recommendations were in keeping with the long-standing priorities of the Department which emphasize readiness and quality of life for our personnel, while at the same time striving to develop more affordable, long-term modernization and recapitalization programs. Direction resulting from the QDR addressed the key factors contributing to funding instability.

Acknowledgment of Operational Contingency Costs
The costs of unplanned contingency operations, such as our operations in

Haiti, Somalia and, currently, Bosnia, have been central to the funding instability problem in recent years. While none of these overseas commitments could have been predicted with certainty, the fact that funding was not allocated in our long-range programming process for these types and levels of operations did lead to sizable transfers of funding from investment programs to offset their costs. Figure 6 documents the historical level of funding required over the past several years and shows that our anticipated funding in the future is far short of the historical norm.

There is widespread belief that the costs of contingency operations are paid through supplemental appropriations from the Congress. The term supplemental is, in fact, a misnomer. The Department seldom gains any net resources in this manner, since we are normally simply given permission to reallocate resources within our existing top line.

Figure 7 illustrates contingency costs compared to the amounts reprogrammed out of the Service investment accounts during the year of execution. As the data demonstrates, most of the costs of contingencies over the past several years have been borne by reductions in investment programs. A similar pattern emerged again this year as we struggled to pay for the costs of operations in Bosnia.

As the data demonstrates, most of the costs of contingencies over the past several years have been borne by reductions in investment programs. A similar pattern emerged again this year as we struggled to pay for the costs of operations in Bosnia.

Although the QDR task force recommended planning and programming for operational contingencies based on the empirical evidence of the recent past, the Department took a more measured approach, and for valid reasons. That decision was influenced both by the uncertain nature of future operations and our ability to accurately forecast these costs far enough in advance to coherently budget for them. There were also obvious political and diplomatic concerns associated with "planning" to conduct such operations.

The QDR report noted that demands from smaller-scale contingencies should be anticipated in the future. Given that we can expect these types of contingency operations to occur, with their associated costs coming from within existing resources, we should be structuring investment programs in a way that permits a graceful extraction of funding. Thus, if a need arises during the execution year, we have an ability to deal with it, without incurring substantial cost penalty.

Realistic Operating and Support Programming

The QDR analysis of the financial risks in the Department's long-range plans and identification of potential sources of funding instability are illuminating. The migration risk was estimated to be as much as $10-12 billion per year arising from unprogrammed bills, unrealized savings, and new program demands. This degree of migration, if unchecked, would have left us far short of satisfying the requirements of the strategy and investment priorities envisioned in the QDR.

To partially address this problem, a recommendation was made and accepted to direct the reallocation of resources freed by reducing force structure and streamlining infrastructure, as well as adjusting some modernization programs, to allow more realistic programming for known O&S costs. By making these prudent reallocations now in out-year planning and programming as a hedge against future migration, the Department took a significant step toward breaking the pattern of continuous budget-year erosion of its investment accounts, which results in sustained program cost growth. The effect over the FYDP period will be a less aggressive increase in investment funding than previously planned. However, this slower ramp-up to the goal of a $60 billion annual procurement level is more likely to be executable given the reality of the funding pressures facing the Department.

Programming Reserves for Technical Risk and Uncertainty

Complex, technologically advanced programs all bear a certain degree of risk. It is the existence of that risk in leading-edge defense programs that gives us the opportunity to maintain a competitive advantage over potential adversaries. But, to couple aggressive cost goals with technical risks in a viable plan for program execution demands sufficient management ability to offset reasonable growth in costs associated with the risk. This management ability is needed not only to provide a "safety net" for pursuing aggressive cost goals, but also to provide a buffer against having to destabilize certain programs to deal with cost growth on other programs.

The QDR analysis concluded that prudent risk reserves in out-year programming were essential to provide the necessary flexibility to offset these types of cost increases and mitigate their influence as a key destabilizing factor affecting investment programs. As a result, technical risk reserves will be programmed beginning in FY 00 at $250 million and increasing incrementally to $1 billion annually by FY 03. These reserves will be held and managed centrally by the Service Acquisition Executives with oversight from the Under Secretary of Defense for Acquisition and Technology. Their use will be limited exclusively to dealing with cost growth due to technical risk and uncertainty (e.g., labor rate changes, inadequate threat definition, unforeseeable facilities and equipment problems, unexpected engineering problems, etc.).

In conjunction with the availability of reserve funding, and in order to facilitate an expressed outcome (i.e., reduced investment program cost), there is a recognition that contractual mechanisms/agreements with contractors must be structured to provide the right incentives for motivating desired behavior. Simply stated, it must be less profitable for program participants to utilize the reserve than

to not utilize it, but the existence of the reserve should encourage the pursuit of aggressive cost-reduction initiatives.

At least initially, the plan is to liquidate the reserves in the budget year, before the budget is submitted to Congress. However, in POM 99, a pilot effort will be undertaken to assess the viability of explicitly identifying reserves in the budget. For this pilot effort, each of the Military Departments will select three major acquisition programs and establish reserves within them at levels which do not expose large amounts of funding, yet provide a high degree of leverage against technical risk and uncertainty that may arise in the year of execution..

Conclusion

The program stability initiatives adopted as a result of the QDR, represent a fundamental rethinking of the way we plan and manage defense programs and resources. Strong leadership commitment and a "top-to-bottom" cultural change will be necessary to successfully institutionalize them in enduring processes. However, having now clearly defined the problem, identified the basic causes, and outlined reasonable measures to alleviate the problem, the Department seems poised to finally confront, in a meaningful way, the decades-old problem of funding instability.

A new Under Secretary of Defense for Acquisition and Technology will shepherd the implementation of these initiatives into practice. But the "Kaminski Initiative" could be the former Under Secretary's greatest legacy of improvement in the defense acquisition business: a legacy of achieving program stability, enabling us to substantially reduce investment costs, field systems faster, and increase the purchasing power of the Department of Defense. Even Sisyphus would stand back in awe of a solution to this secret of the gods.

The "official standard" Internet address for reaching the faculty at DSMC follows:

Last Name_First Name@dsmc.dsm.mil

(Example: doe_john@dsmc.dsm.mil)

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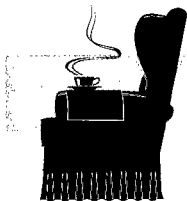
A WORD FROM DSMC'S AIR FORCE CHAIR

TONY KAUSAL

Thanks to Dr. Paul Kaminski, former Under Secretary of Defense (Acquisition and Technology), for his leadership efforts in moving us along the road of acquisition reform. **Congress** continues to look at the issues of Contractor Logistics Support and Interim Contractor Support in several hearings. The primary question: Should these be counted in the 60/40 work requirement?

For those covered by the **Defense Acquisition Workforce Improvement Act,** Congress is still interested in its implementation. They recently invited the Service Acquisition Executives (SAE), or their principal deputies, to Capitol Hill for a look at how we are managing the workforce. The major issue seems to be the definition of the **acquisition workforce**.

Eleanor Spector, the Director of Defense Procurement, recently revised the **Value Engineering** clause, increasing the incentive for contractors to use this valuable tool. The revised Federal Acquisition Regulation (FAR) language changes the sharing period for savings from the current *three years,* to a range of *three to five years*. The incentive sharing arrangement also changed from the current fixed rate for the contractor of 50 percent, to a range of 50 to 75 percent. The collateral savings rate (savings on other contracts) changed from a flat rate of 20 percent to allow a range of 20 to 100 percent. Hopefully, this change will encourage the use of Value Engineering within the Services.

DSMC has a new **Chair** for the Executive Institute, Ron Register. He will be the **Defense Acquisition Research Projects Agency Chair** and will provide a perspective on the Science and Technology programs to both faculty and students. **Welcome** to DSMC's newest Visiting Professor and the Army's former SAE, Gil Decker.

The latest **FAR Part 15** proposal is out for public comment. For those non-FAR people, this is the section that governs source selections, including evaluation factors; proposal evaluation, including past performance; and communications with contractors. **Preview**—The rewrite re-emphasizes the policy on using past performance as a quality factor and the requirement to assume competition provides price reasonableness (that means not asking for certified cost and pricing data!). The Procuring Contracting Officer can limit the competitive range to an efficient number of proposals to evaluate. It used to be that all offerers were kept in the competitive range, unless they had no chance of revising their proposal to make it acceptable. This cost the government and contractors time and money. The rewrite also allows the contracting officer the ability to inform the contractor that his or her price is too low or too high. **Many industry** people are concerned that this will lead to auctioning. And finally, the rewrite clarifies communication with offerers during the source selection. The issue remains: If I ask to verify information on past performance, have I started negotiations? In a related case, the General Accounting Office recently declined to rule on whether or not the question-and-answer sessions, as part of the oral proposal, actually amount to discussion. While this sounds like one of those archaic contracting issues, the impact of an unfavorable opinion (i.e., **they are discussions**) would take away one of the benefits of oral proposals—a speedier source selection.

The latest listing of **top DoD** contractors (FY 96) is out, with Lockheed Martin leading the pack at almost $12 billion, followed by McDonnell Douglas at $9.9 billion.

On May 16, Secretary Cohen sent to Congress the **Quadrennial Defense Review (QDR)**, which reviewed all aspects of the Defense Strategy and Programs, including force structure, infrastructure, readiness, intelligence, modernization, and people. The impact to us: Following the **QDR**, Secretary Cohen established **a task force on Defense Reform**, which will recommend organizational reform, reductions in management/overhead, and streamlined business practices.

Looking for some good acquisition reading? So am I! Any recommendations from our readers? If so, please send via E-mail to—

KausalT@dsmc.dsm.mil

That's it from the Chair—keep on golfing!

PROGRAM MANAGEMENT.
EVERYBODY NEEDS TO START SOMEWHERE...
SOME PEOPLE NEED A REFRESHER.

NOW DEFENSE INDUSTRY EXECUTIVES
GET THE SAME TRAINING AT DSMC AS THEIR
GOVERNMENT COUNTERPARTS...TUITION FREE!

THAT'S WHERE WE ENTER THE PICTURE. Defense industry executives are invited to attend the Defense Systems Management College and learn the defense acquisition management process side-by-side with their military and government civilian counterparts. Vacancies are now available in DSMC's highly acclaimed 14-week Advanced Program Management Course at the main Fort Belvoir, Virginia, campus. Tuition is waived for eligible students. The next class is May 12-Auguest 15, 1997; the following class will be September 8-December 12, 1997. Contact Ruth Franklin, CODSIA Registrar, at (202)371-8414 for information.

THE DEFENSE SYSTEMS MANAGEMENT COLLEGE
A MEMBER OF THE DEFENSE ACQUISITION UNIVERSITY CONSORTIUM
HTTP://WWW.DSMC.DSM.MIL   (703) 805-2828

Retired Air Force Master Sgt. John Garnish became the Director, Video Services, effective March 17, 1997. He previously served as Noncommissioned Officer in Charge and Acting Director of Video Services from October 1993 until his retirement from active duty in July 1996. Garnish fills the position vacated by Michael Dee, former Director of Video Services, who died in October 1994.

William H. Hauenstein became the Acting Navy Chair, DSMC Executive Institute, effective April 1, 1997. Currently assigned to the Office of the Assistant Secretary of the Navy for Research, Development, and Acquisition, he is the Navy's first Director of Acquisition Career Management, a position he assumed in November 1991. Hauenstein, a retired Navy Rear Admiral, is the Department of the Navy's authoritative expert on acquisition workforce issues, and also serves as Executive Director to the Navy's Acquisition Workforce Oversight Council, Chairperson of the Navy's Acquisition Career Program Board, and Administrator of the Navy's Acquisition Workforce Program.

Brian Knighton became the Director, Facilities Maintenance Department, effective March 2, 1997. A DSMC maintenance employee since 1991, Knighton has been serving as Acting Director of the Department since the retirement of his predecessor, Clinton Osborne, on January 3, 1996.

Gibson LeBoeuf, Navy Chair, DSMC Executive Institute, was reassigned effective March 30, 1997, to the International Programs Office, Crystal City, Va. A DSMC employee since June 1989, LeBoeuf's current position is Deputy Director, Navy International Programs.

Dr. Thomas J. Pojeta became the Acting Army Chair, DSMC Executive Institute, effective June 16, 1997. He comes to DSMC directly from the Industrial College of the Armed Forces (ICAF), National Defense University, where he graduated on June 13, 1997, with an M.S. in National Resource Strategy. Prior to attending ICAF, Pojeta served as Technical Director and Advisor, Army Special Projects Support Activity, U.S. Army Special Operations Command. He is a member of Army Materiel Command's Senior Management Executive Development Program and the Army Acquisition Corps.

Ron H. Register became the Defense Advanced Research Projects Agency (DARPA) Chair, DSMC Executive Institute, effective June 16, 1997. Register is currently transitioning to DSMC from DARPA where he has served as Deputy Director for Management, and Senior Acquisition Executive since 1989. Register is a former Adjunct Professor, The George Washington University, and a member of the Senior Executive Service.

Longuemare Endorses Two Important Modeling and Simulation Documents

RANDY ZITTEL

In 1993, the Army established a policy requiring that all major program managers (PM) plan their use of modeling and simulation (M&S) throughout their programs. Because early planning in a program or project is crucial, and M&S is expensive, the Army weighed carefully its decision to require that all PMs document their planning efforts in a specific Simulation Support Plan (SSP). The positive potential of M&S for accelerating schedules, reducing cost, and improving quality was a key acquisition reform initiative that Army senior acquisition managers wanted to exploit. Because of the SSP's effectiveness, in 1996 the Army expanded its SSP requirement to include ACAT III and IV Army program and product managers. The intent was to provide program and product managers a management tool that would result in increased M&S focus and coordination.

The Army recently published an excellent pamphlet to assist PMs in better understanding the importance and value of the SSP. The Assistant Secretary of the Army for Research, Development, and Acquisition just released *Simulation Support Plan Guidelines*, May 1997, to all acquisition managers.

In a memorandum to all other Service Acquisition Executives, May 2, 1997, R. Noel Longuemare, Principal Deputy Under Secretary of Defense for Acquisition and Technology, provided copies of the SSP Guidelines, and recommended their use in all Department of Defense (DoD) programs.

The *Simulation and Support Plan Guidelines* will soon be available on the Assistant Secretary of the Army for Research, Development, and Acquisition (ASARDA) Home Page:

http://www.sarda.army.mil

To obtain a copy of the *Guidelines*, send an E-mail to: **purdye@sarda.army.mil** or call (703) 614-5920.

Another important document relating to current use of DoD M&S came out of the Office of the Secretary of Defense (OSD). Its "Study on the Effectiveness of Modeling and Simulation in the Weapon System Acquisition Process" is an excellent overview of current DoD use of M&S and its potential for the future. The all-encompassing concept of SBA is introduced here, and the study provides a tremendous wealth of M&S use in current programs. Longuemare distributed the study report to all major DoD PMs in his memorandum of March 28, 1997, as an indication of M&S value, and challenged each PM to use M&S to the maximum extent possible, "to continuously reduce life cycle costs." This capstone study is available through the Defense Modeling and Simulation Home Page (**http://www.dmso.mil**) on the World Wide Web.

Editor's Note: Zittel is a Professor of Systems Engineering, Faculty Division, DSMC.
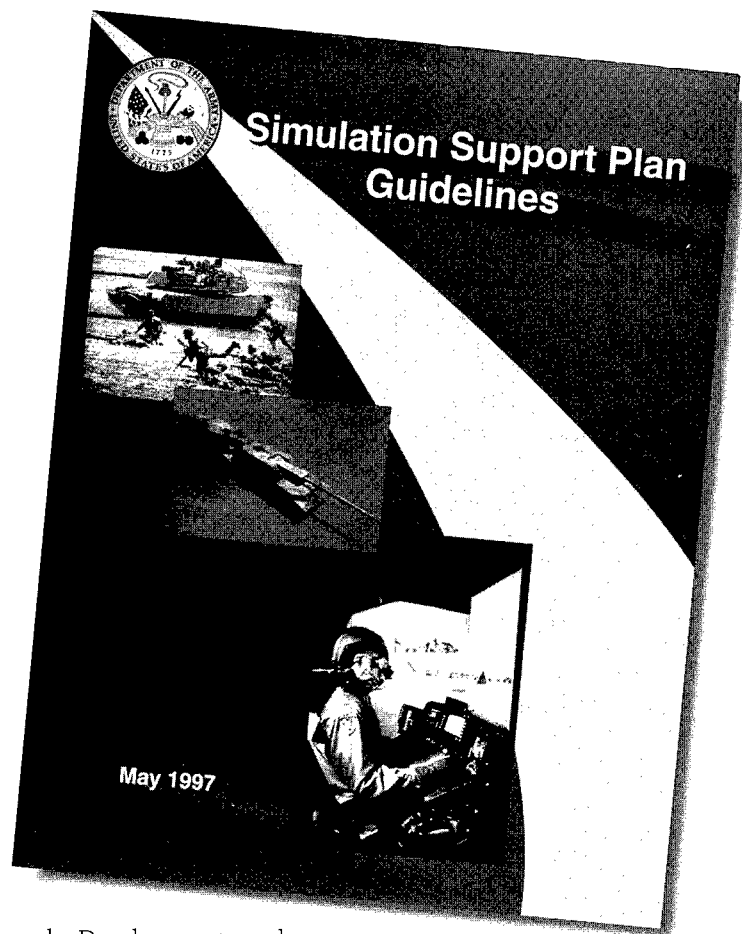
THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

MAY 2 1997

ACQUISITION AND
TECHNOLOGY

MEMORANDUM FOR COMPONENT ACQUISITION EXECUTIVES

SUBJECT: Simulation Support Plans

As part of our reform efforts, I have continued to encourage an increasing emphasis on the use of modeling and simulation (M&S) in our acquisition programs to reduce cost and schedule without sacrificing quality or performance. A key initiative in this area is the concept of Simulation Based Acquisition (SBA), the employment of models and simulations across all functional areas throughout the entire acquisition life cycle.

To foster the use of M&S in acquisition, and as part of their move towards SBA, the Army recently published the attached "Simulation Support Plan (SSP) Guidelines." The SSP, in widespread use within the Army, is a means for developing and implementing an effective strategy for the use of M&S throughout a program's life cycle, and facilitates a Program Manager's (PM's) thinking through and resourcing a M&S program. The SSP *Guidelines* provide guidance to PMs on developing such a plan, and highlight the issues the PM should address in identifying how M&S can support system development throughout the entire acquisition life cycle.

These guidelines not only provide a useful tool for the PM's M&S tool kit, but are also a good example of how the acquisition community can begin to implement the concept of SBA. I therefore encourage you to make these Army guidelines known and available to your communities as one more step towards developing and fielding our systems as efficiently as we possibly can.

R. Noel Longuemare
Principal Deputy

Attachment

PRINCIPAL DEPUTY UNDER SECRETARY OF DEFENSE

3015 DEFENSE PENTAGON
WASHINGTON DC 20301-3015

ACQUISITION AND
TECHNOLOGY

MAR 28 1997

MEMORANDUM FOR PROGRAM EXECUTIVE OFFICERS
ACAT I PROGRAM MANAGERS
ACAT II PROGRAM MANAGERS

SUBJECT: Study on the Effectiveness of Modeling and Simulation in the Weapon System
Acquisition Process

As you continue to manage weapon system acquisition programs to the highest standards,
you have many resources available to assist you in building affordable, executable strategies. I
urge you to count this study as one of the many sources of information you use as you plan and
execute your programs.

This study will aid you in getting a perspective on the modeling and simulation (M&S)
tools and technologies available that can positively impact your program management. Many of
the examples in this study reinforce what I continue to emphasize: emerging technologies,
integrated with systems engineering, can result in cost avoidance through process efficiencies in
your program's life cycle. They can also reduce your program's acquisition cycle time.

Performance, cost, and schedule are central to the execution of your programs, and you can
influence each of these by leveraging some of the M&S tools and technologies available in the
commercial and defense communities today. I challenge each of you to continue to insert
emerging technology at an affordable cost and to use available processes to continuously reduce
life cycle costs. You can make a difference in changing the way we execute programs.

R. NOEL LONGUEMARE

Attachment:
As stated

Simulation Based Acquisition

An Effective, Affordable Mechanism for Fielding Complex Technologies

DR. PATRICIA SANDERS

D efense modernization has come a long way technologically, and the United States may have reached a point where it is paying a penalty for past successes. During the Cold War, some argued that the country should not purchase the equipment the nation's industries were producing because it was unlikely to work. Today, not long after the Persian Gulf experience, these same people allege the government should not purchase the equipment that is being produced because it works so well no more is needed.
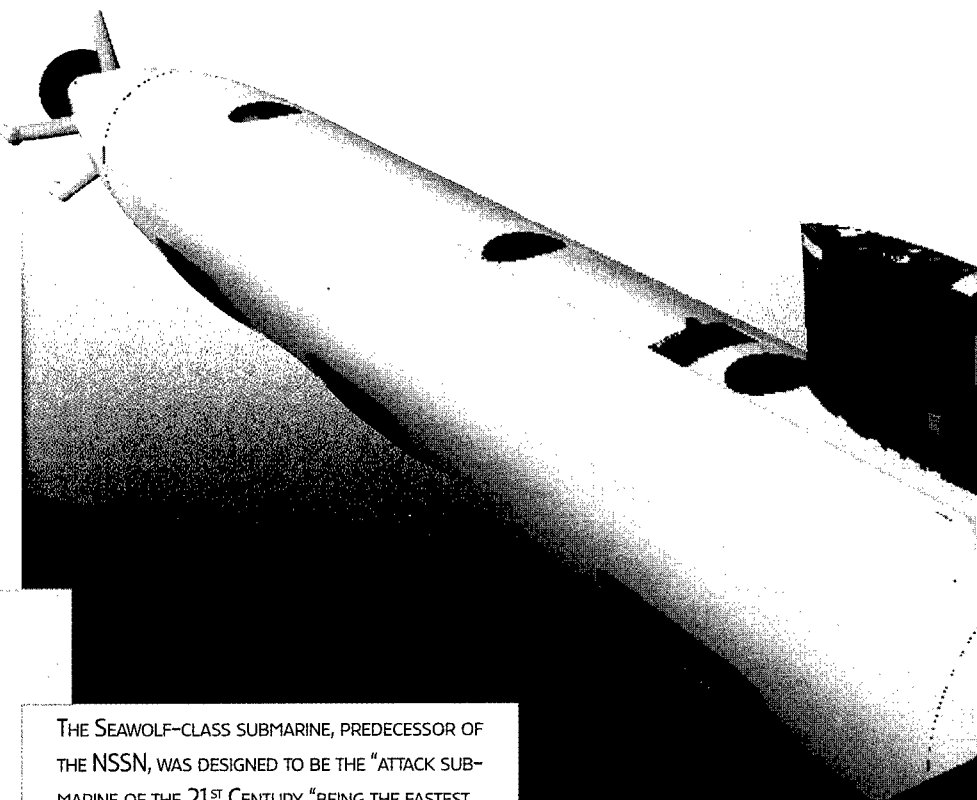
THE SEAWOLF-CLASS SUBMARINE, PREDECESSOR OF THE NSSN, WAS DESIGNED TO BE THE "ATTACK SUBMARINE OF THE 21ST CENTURY, "BEING THE FASTEST, DEEPEST DIVING, AND MOST HEAVILY ARMED SUBMARINE EVER BUILT BY THE UNITED STATES."
U.S. Navy photo

NORM AUGUSTINE, CHIEF EXECUTIVE OFFICER OF LOCKHEED MARTIN, POINTED OUT SOME YEARS AGO THAT THE COST OF EACH SUCCESSIVE GENERATION OF FIGHTER AIRCRAFT WAS INCREASING GEOMETRICALLY...SOME TIME IN THE MIDDLE OF THE NEXT CENTURY, THE COUNTRY WOULD BE ABLE TO AFFORD ONLY ONE FEARSOME, SOPHISTICATED AIRCRAFT!
Photo by Bachrach

Sanders is the Director, Test, System Engineering and Evaluation, Office of the Under Secretary of Defense (Acquisition and Technology).

The national security environment has changed too. In the post-Cold War world, the United States no longer faces a single, galvanizing threat such as the former Soviet Union. Instead, there is increased likelihood that U.S. forces will be committed to limited regional military actions. A statistician might say, the *mean value* of the *single* greatest threat is considerably *reduced*, but the *variance* of the *collective* threat the country must be prepared to meet has *increased*.

In response to the reduced *mean value* of the threat, the United States has cut end strength by about one-third from 1985 levels. At the same time, the increase in *variance* has resulted in a one-third increase in the number of U.S. force deployments.

Procurement Reductions

The overall U.S. Department of Defense (DoD) budget has been cut by about one-third in real dollars since its peak in the late 1980s. When one considers that the procurement budget changes by two percentage points for every percentage point the overall DoD budget changes (up or down), one realizes that a significant decrease (about two-thirds) in procurement funding has taken place.

Traditionally, procurement has been the most volatile component of a DoD budget drawdown because —

- the acquisition of new equipment for a smaller force structure is viewed as unnecessary; and

- there is an emphasis on near-term readiness and a willingness to gamble on what constitutes acceptable technology.

The effect of such procurement reductions on the ultimate user of the equipment, i.e., the soldier, sailor, airman, or marine, must not be underestimated. If the issue of equipping the military forces is seen as a business proposition, one can readily calculate — by dividing the value of all tangible assets the DoD owns (exclusive of land and buildings) by the annual reinvestment in those same assets — that the average item of military equipment in America's inventory will have to last 54 years! This in a world where technology generally has a half-life of from two to 10 years, and combat casualties are directly related to the quality of technology employed.

Since this approach to the budget defers long-term modernization and is certain to have an adverse effect on future readiness, it must be interpreted as a temporary condition.
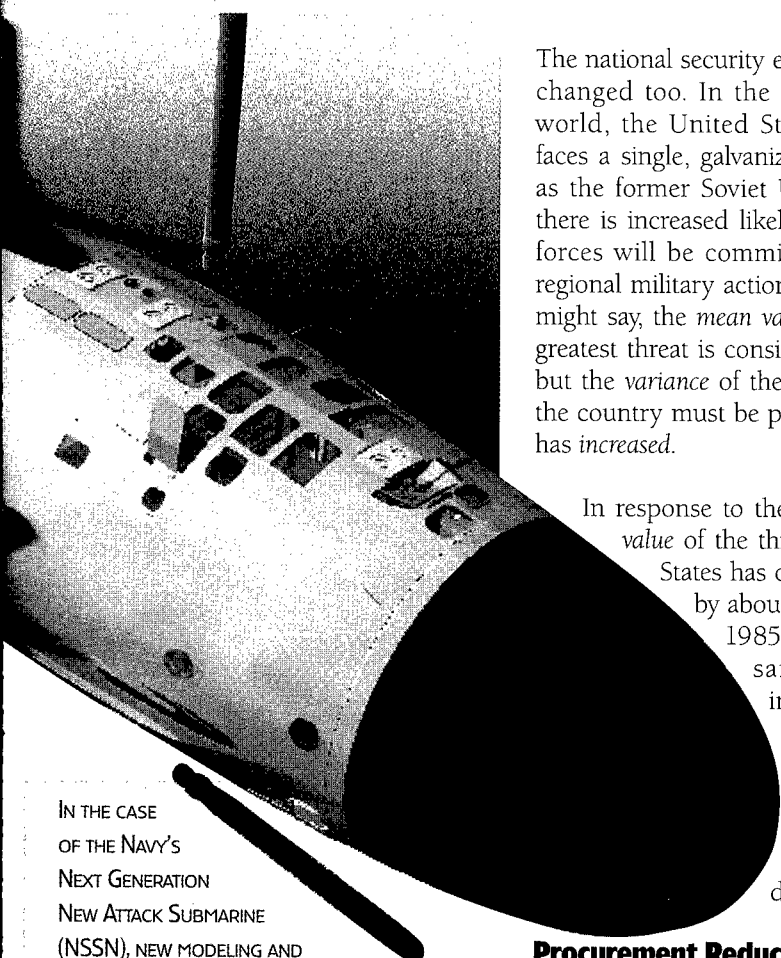
Need for Modernization Strategy

In view of the overall federal budget, it is only realistic to assume there will be continued pressure to limit increases in defense investment spending. In such a climate, it is important to think in terms of a *modernization*, rather than *recapitalization*, strategy for equipping U.S. forces. *Recapitalization* suggests a one-for-one replacement of existing platforms with new platforms having similar capabilities. *Modernization* means developing and fielding fewer, more capable systems. The key question is: Can the Defense Department afford a modernization-based investment approach? Technological complexity is certain to increase, dramatically in many instances.

Norm Augustine, Chief Executive Officer of Lockheed Martin, pointed out some years ago that the cost of each successive generation of fighter aircraft was increasing geometrically. As a result, although fighter aircraft were becoming more and more deadly, the United States could afford fewer and fewer of them. Augustine's calculation — an empirical plot of aircraft unit cost as a function of deployment date — was that by some time in the middle of the next century, the country would be able to afford only one fearsome, sophisticated aircraft!

The geometric increase in cost results because complex technologies become more and more interdependent. For example, a radio can interfere with aircraft flight controls or have an impact on electronic warfare equipment. To reduce radar signatures, designers may have to shape an aircraft in a way that forces them to move engines, weapons, and even the pilot. Any of these actions can affect other parts of a system's operation, not to mention its producibility or logistics support.

It is essential to remember that Augustine's prediction is empirical. It is based on past experience and processes for handling the interaction of increasingly complex technologies. Industry and the DoD need to share
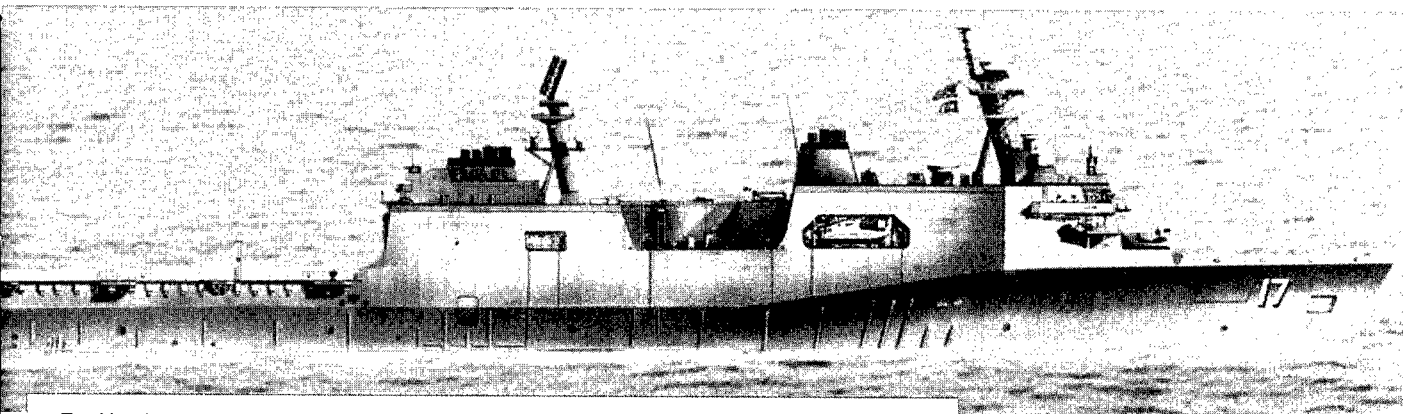
responsibility for finding an alternative path to fielding affordable, modern systems.

Becoming a "Smart Buyer"

The DoD needs to become a "smart buyer," in terms of both *what* and *how* it buys equipment. The *"what"* is at least as important as the *"how."*

What to Buy?

To determine what it will buy, the DoD is placing considerable emphasis on a "system-of-systems" decision-making approach, or construct. The goal is to select the most cost-effective mix of individual systems for development and fielding. Tradeoffs between on-board and off-board capabilities are being considered, and alternative systems are being evaluated under simulated combat conditions.

Recently, the Heavy Bomber Study looked at the adequacy of the planned bomber force in the context of a two-major-region, contingency scenario. The Strategic Airlift Force Mix Analysis and Tactical Utility Analysis were used to evaluate the cost effectiveness of various mixes of C-17 aircraft and nondevelopmental airlift platforms to perform airlift missions in support of various contingency operations. A similar study is currently in progress to evaluate the mix of accurately guided weapons the Department is procuring.

A hierarchy of models and simulations is being used to support these studies and to help make the what-to-buy decisions. First, at the engagement or system level, the system effectiveness against an adversary system is evaluated. Later, at the mission/battle or force-on-force level, the ability of a multiple platform force package to perform a specific mission is assessed. Finally, in theater- or campaign-level simulations, the conflict outcomes are determined for a total package of Joint and Combined forces.

Extensive use of constructive models for these system-of-systems evaluations is anticipated. Eventually, there will be much greater use of virtual pro-

totypes operated on synthetic battle-fields. Without question, the DoD is moving toward greater use of simulation-based system evaluations.

The Department's what-to-buy decisions are also being driven by life-cycle-cost-performance trades where cost is an independent variable. Gone are the days when performance was paramount, and cost took a back seat and was treated as a dependent variable. Life-cycle-cost-performance trades require evaluation of alternative designs and concepts. Computer modeling and simulation, including virtual prototypes, are needed to assess the performance of alternative designs in a simulated combat environment. They are also needed to examine the logistics, manufacturing, and producibility implications of alternative designs, and the cost and schedule impacts of pursuing alternative designs.

How to Buy?

The DoD must also change how it buys. The Department has worked to find the best methods for reengineering its processes. In May 1995 the Secretary of Defense directed a "fundamental change in the way we acquire goods and services" and mandated that the concepts of Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPT) "be applied throughout the acquisition process to the maximum extent possible."

The DoD defines IPPD as "a management process that integrates all activities from product concept through production/field support, using a multifunctional team, to simultaneously optimize the product and its manufacturing and sustainment processes to meet cost and performance objectives." An outgrowth of concurrent engineering practices, the IPPD process reflects a systems engineering approach that has incorporated sound business practices and commonsense decision making. Fundamental to the successful implementation of the IPPD concept will be the willingness of organizations to undertake and experi-

ence profound changes in their cultures and past practices.

To reduce the costs associated with the integration of complex systems, it will be essential for the functional members of an IPT (e.g., design engineering, manufacturing, logistics, product support) to understand the concerns of their counterparts and to identify a program's technical challenges as early as possible. Tools available to an IPT include standard, relatively inexpensive computer equipment, virtual prototypes, and simulations. Such resources can aid in the development of a shared vision of the proposed system and provide a means for understanding the complex interactions among the configuration items in the system design.

The real power of a computer-based modeling and simulation system lies in the connection and coordination between the tools and the functional users. In addition to increasing the effectiveness of the design and manufacturing functional specialists, the product support members of the team (e.g., testers, logisticians, and maintainers) will benefit as well.

Simulation Based Acquisition

The DoD envisions an acquisition process supported by the robust, collaborative use of simulation technology that is integrated across acquisition phases and programs. The objectives of Simulation Based Acquisition (SBA) are to —

- reduce the time, resources, and risk associated with the acquisition process;

- increase the quality, military utility, and supportability of systems developed and fielded; and

- enable IPPD from requirements definition and initial concept development through testing, manufacturing, and fielding.

Substantial evidence has already accumulated regarding the value of a simu-

> **The real power of a computer-based modeling and simulation system lies in the connection and coordination between the tools and the functional users.**

lation-based approach to acquisition. Both commercial and military programs provide pervasive evidence of tangible results that can be measured in terms of improvements in *cost, schedule, productivity,* and *quality/performance.*

Cost
The LPD-17 program saved $6 million in design costs through the use of new modeling and simulation tools. At the same time, it was able to eliminate 100 tons in topside weight, a design change expected to result in greatly improved performance. In the Joint Strike Fighter program, it is projected that virtual manufacturing techniques may save as much as 3 percent of the program's estimated life-cycle cost, which could be $5 billion.

Schedule
The use of modeling and simulation tools and processes by the "big three" auto manufacturers has reduced the time from concept approval to production from five to three years, and significant further schedule reductions

are anticipated. Separately, Electric Boat™ reports it has been able to halve the time required for submarine development, from 14 to seven years.

Productivity
Productivity is also affected by the increased use of modeling and simulation. The required level of effort (person years) is often less, and fewer workers may be needed. Costly intermediate steps (e.g., mockups, redesigns, and engineering changes) can frequently be avoided, there is reduced scrap, and less manufacturing floor space is required when modeling and simulation are used.

It took 38 Sikorsky draftsmen approximately six months to develop working drawings of the CH-53E Super Stallion's outside contours. In contrast, using modeling and simulation one engineer was able to accomplish the same task for the Commanche helicopter in just one month. In another instance, 14 engineers at the Tank and Automotive Research and Development Center designed a new, low-silhouette tank prototype in only 16 months, a task that would have required approximately 55 engineers and three years with more traditional methods.

Quality/Performance
The positive impact of modeling and simulation on quality and performance can be seen in a number of areas, e.g., the proper assembly of products and systems, fewer instances where rework is needed, a reduced parts count, and the opportunity for early design evaluation prior to further design efforts.

For example, Northrop's use of CAD [computer-aided design] systems led to a first-time, error-free, physical mockup of many sections of the B-2 aircraft. In the case of the Navy's Next Generation New Attack Submarine, new modeling and simulation tools helped reduce the standards parts list to about 16,000 items from the 95,000 items listed for the earlier Seawolf-class submarine.

Embracing This Approach — What is Needed?

It is clear that IPPD, backed by a strong commitment to computer-based modeling and simulation tools, provides a dominant and competitive edge in the commercial marketplace and a distinct warfighting advantage on the battlefield. It provides an alternate path for getting to market first, at lower cost. In the process, quality is improved. The underlying technology is widely available, and market forces are driving industry toward SBA. So what is needed to fully embrace this approach?

SBA is comprised of three principal components. The first is an *advanced systems engineering environment* that uses formal methods and automation to support efficient design synthesis, capture, and assessment, as well as other complex life-cycle activities. The SBA engineering environment provides a means for executing a process that can be extended, tailored, and repeated. The process results in the creation of reusable design repositories and products that can be reengineered. The potential gains from the use of such an advanced SBA environment will not be realized until the engineering process, as well as its people and organizations, also evolve.

The second component is a *refined system acquisition process* that takes advantage of the SBA systems engineering environment capabilities. The third component is a culture that has evolved to a point where *enterprise-wide cooperation* is the rule, and individual technical contributions and innovations are encouraged and managed efficiently.

SBA *is not an incremental step* beyond current system engineering methods and tools. Instead, it represents *a major paradigm shift* toward a comprehensive, integrated environment that addresses the entire system development life cycle and the spectrum of engineering and management domains.

> **It is clear that IPPD, backed by a strong commitment to computer-based modeling and simulation tools, provides a dominant and competitive edge in the commercial marketplace and a distinct warfighting advantage on the battlefield.**

The benefits from the SBA process will be realized not only as time and cost savings within individual programs, but also as cost savings when a program makes use of design repositories and reengineered tools and products from other programs.

Cross-Program Use of Data, Tools, and Techniques

Modeling and simulation tools, as enablers for IPPD development, are already being applied successfully to reduce development time and life-cycle costs in a range of ongoing acquisition programs. The issue is no longer whether extensive use of modeling and simulation tools has merit, but rather how to develop and apply a new acquisition process in a deliberate and coordinated manner that uses these tools to maximum advantage and achieves even more dramatic reductions in cost, schedule, and risk.

The challenge for acquisition reform is to provide the catalyst that will expand the growing successful use of modeling and simulation tools beyond vertical applications within individual programs. If this is accomplished, even

more significant benefits will be realized through the shared use of data, tools, and techniques by government and industry. Unambiguous communication is required to achieve full application of the IPPD and IPT processes; such communication can serve as the catalyst that encourages a new acquisition culture to use these powerful new tools and processes.

Partnership

The challenge is clear: The trend toward geometrically escalating costs in successive generations of defense equipment must be reversed. Limiting the sophistication, and therefore the capability, of future systems is not a realistic option. The task is to field increasingly complex technologies at a more affordable cost, in less time.

This will require a team effort by industry and the DoD to field a superior capability, affordably and in less time than potential adversaries. Industry needs to use the latest information technologies to upgrade its integrated product capabilities. The DoD needs to become a smarter buyer. Together, industry and government must ensure that the acquisition management culture evolves to —

- take advantage of IPPD approaches that stress the need for a shared vision and continuous insight to ensure that quality is built into programs from the start;

- emphasize prevention over cures by using virtual prototypes and simulations to identify and resolve problems early; and

- focus on overall program success, not functional area performance.

The appropriate vehicle for meeting this challenge is SBA, a method which combines a new process, new tools, and a new culture to develop a strong collaborative partnership between government and industry.

DR. PATRICIA SANDERS

**Director
Test, Systems Engineering
and Evaluation (DTSE&E)**

D r. Patricia Sanders is the Director, Test, Systems Engineering and Evaluation (DTSE&E) for the Department of Defense (DoD) where she is responsible for ensuring the effective integration of all engineering disciplines into the system acquisition process. These include design, production, manufacturing and quality, acquisition logistics, modeling and simulation, and software engineering, with emphasis on test and evaluation as the feedback loop. She is also responsible for oversight of the Department of Defense's Major Range and Test Facility Base (MRTFB) and the development of test resources such as instrumentation, targets, and other threat simulators. The MRTFB comprises more than 50 percent of the DoD land resources, represents a capital investment of more than $25 billion, and employs approximately 47,000 government and contractor personnel. Sanders chairs the Defense Test and Training Steering Group, the Systems Engineering Steering Group, and the Acquisition Council on Modeling and Simulation. She reports directly to the Principal Deputy Under Secretary of Defense for Acquisition and Technology.

Sanders has over 22 years of experience in the Department of Defense with particular emphasis in the areas of test and evaluation, modeling and simulation, resource allocation, and strategic planning. Prior positions within the Office of the Secretary of Defense included serving as the Deputy Director for Test Facilities and Resources, the Director of Land Forces in the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, and as a Staff Specialist for the Director of Operational Test and Evaluation. Other assignments have included serving as Deputy Director for Analysis, United States Space Command; Science Advisor to the Command, Control, Communications, and Countermeasures Joint Test Force; and Chief of Modeling and Simulation and Technical Advisor to the Electronics Systems Division at the Air Force Operational Test and Evaluation Center. Her government career was preceded by university faculty positions.

Sanders received her doctorate in mathematics in 1972 as a National Science Foundation Fellow at Wayne State University and is a 1992 graduate of the Senior Executive Fellow Program, John F. Kennedy School of Government, Harvard University. She is a member of the Senior Advisory Board and a past President of the International Test and Evaluation Association (ITEA), a Fellow of the American Institute of Aeronautics and Astronautics, and a member of the Board of Directors of the Military Operations Research Society.

Modeling and Simulation (M&S) Use in the Army Acquisition Process

Shift to Simulation Based Acquisition Recognizes M&S As Tremendous Opportunity for PMs

DR. HERBERT K. FALLIN, JR.

A new paradigm is emerging in the Army regarding the use of Modeling and Simulation (M&S) in the acquisition process. This new paradigm is Simulation Based Acquisition (SBA). Under the old school of thought, M&S was regarded as just another tool to be used in the design of a weapon system. The shift to SBA recognizes that M&S represents tremendous opportunity for the program manager (PM) and is more than just a tool to be taken for granted. PMs today recognize that M&S must be managed as a resource in order to achieve the benefits inherent in the use of M&S throughout the acquisition process. In order to capitalize on these benefits, PMs must be savvy in two critical areas:

- What is SBA?
- Just how it is implemented?

The use of M&S in the acquisition process is nothing new to the Army. What is new is the increasing availability and power of M&S tools and the decreased availability of resources for weapon system development. These two occurrences have served as a forcing function, steering the acquisition community into better integrating the

Figure 1. **What is Simulation Based Acquisition?**
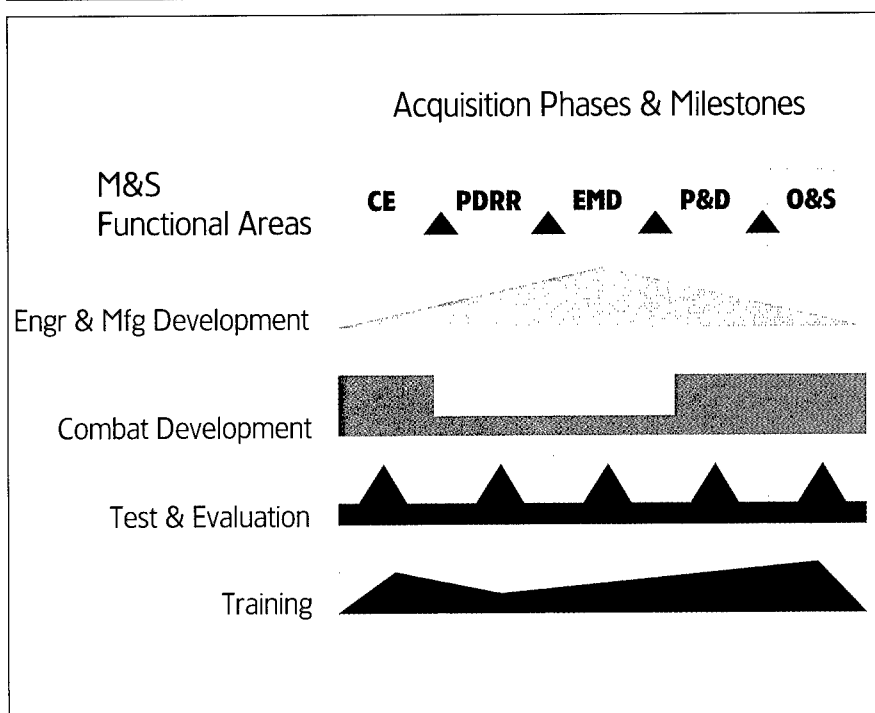
use of M&S throughout all phases of the acquisition cycle, to ultimately deliver fielded systems within imposed budget constraints. When properly incorporated into a program, SBA yields the following benefits, which act to reduce risk in cost, schedule, and performance:

- Continuous evaluation of system development.
- Rapid evaluation of concept design.
- Reduce and delay need for physical prototype.
- Facilitate continuous user participation in development process.
- Efficient development/evaluation of manufacturing plans.
- Reuse of system software and hardware in training simulators.
- Ability to test proposed system at sub-component, component, and system level.

Fallin is the Director, Assessment and Evaluation, Office of the Assistant Secretary of the Army (Research, Development, and Acquisition). He holds a B.A. in Mathematics-Physics-Education from Western Maryland College; an M.A. in Mathematics from West Virginia University; and a Doctorate in Statistics from the University of Delaware. He is a an adjunct full professor at American University; a graduate of the Federal Executive Institute; and a graduate of the John F. Kennedy School of Government. Prior to his return to the Pentagon in 1993, Fallin was the Scientific Advisor to the Supreme Allied Commander Europe (SACEUR) at Supreme Headquarters Allied Powers Europe (SHAPE) in Mons, Belgium. Fallin is a 1995 Presidential Meritorious Executive.

What Is Simulation Based Acquisition?

SBA is a concept for efficiently managing M&S as a resource to be exploited by the PM in the effort to accomplish acquisition objectives. As we shift toward more efficient and effective use of M&S, the abandonment of "stovepiping" techniques for employing M&S must become a reality. The boundaries imposed by the acquisition phases and milestones are no longer constraints to those who optimize the use of M&S. Re-use of M&S for multiple functions and linking different models and simulations across all phases of acquisition is a powerful concept with benefits that are currently being realized. SBA is characterized by a more flexible and integrated approach to using M&S in the acquisition process.

As depicted in Figure 1, the utility of the SBA concept to the PM lies in the notion that M&S developed for use in a functional area can serve in a similar capacity to accomplish tasks in each of the phases, from concept exploration

to operations and support (O&S). Usually the M&S evolves as the program progresses until a full suite of models evolves, which represents the entire weapon system. Linking models together using one model's output data as input data for another model generates efficiencies for the PM that allow reductions in cost and schedule.

Identifying how M&S can be used across the acquisition phases and in the various functional areas represents the first step in developing the Simulation Support Strategy. This strategy focuses on the appropriate mix, type, and fidelity of M&S tools. One of the largest barriers to the effective execution of the Simulation Support Strategy in the Army was the inability to clearly articulate M&S requirements to those responsible for the actual development of M&S. To rectify this problem, the Simulation Support Plan (SSP) Guidelines, which are discussed later in this article, were introduced. These guidelines require Army PMs to craft a Simulation Support Strategy and package this strategy in a format

that clearly identifies and communicates M&S requirements to the modeling community — a format referred to as the "M&S Tool Kit."

Figure 2 illustrates the mapping of M&S tools to M&S requirements. This is the essence of the SSP.

How To Incorporate SBA

The SSP is the implementing tool the Army uses to employ M&S in the most effective and efficient manner possible. This construct was initiated in 1993 by the Military Deputy to the Army Acquisition Executive. In 1996, OSD implemented a policy that required all ACAT I and II programs to coordinate their SSPs with various Army activities and include an M&S strategy summary in the Acquisition Strategy Report. The SSP Guidelines, published and distributed in May 1997, further supplemented this guidance. Additionally, in his May 2, 1997, memorandum, the Principal Deputy to the Under Secretary of Defense for Acquisition and Technology encouraged all the Services to use the Army's SSP Guidelines as a model for PMs to organize their respective M&S strategies and implement SBA.

The intent of the SSP is to provide a management tool that assists the PM in thinking through M&S requirements for the acquisition program. Additionally, the SSP provides visibility of M&S capabilities to not only the PM and supporting communities, but to other system PMs and programs in other Services. Such visibility promotes possible re-use of M&S.

The SSP, when properly crafted, conveys more than just what M&S is being used to support the program. It provides a road map to the PM, and the acquisition community, which indicates what types of M&S are required and when the M&S is needed to meet program objectives. The SSP is the vehicle that allows the PM to thoroughly integrate the use of M&S into the acquisition strategy. Figure 3 shows how the SSP road map ties in directly with the acquisition strategy.

Figure 2. **Generic Top-Down Level Representation of an SSP**

M&S TOOL KIT **M&S USER REQUIREMENTS**

End-to-End Digital Simulation

Component Models Full Syst Model

F-F Simulation

+ HWIL

Virtual Simulation

Virtual Prototype System Hardware

Cost Model

Engr/Mfg Dev
- design
- mfg
- logistics

Cbt Dev
- O&O concept

T & E
- test
- evaluation

Training
- collective

Acquisition Life Cycle Process   Acquisition Life Cycle Process

Figure 3. SSP "Road Map" Integration with Acquisition Strategy

AcquisitionStrategy

	CE	PDRR	EMD	P&D
Milestone	MSI	MSII	MSIII	
Solicitation	DEM-VAL	EMD	LRIP FRP FRP	
Contract Award	DEM-VAL PDR CDR	EMD PDR CDR LRIP	FRP	
Deliveries		Prototype	EMD LRIP	
Sys Design/Eng	SW	SW/HW	SW/HW	
T&E		DTE EUTE	DT&E OT LFT&E	
SSP				

SSP Road Map

Engineering Development	C / D	VP C / D	VP C / D	VP C / D
Combat Development	CM	S	CM	
T&E		VP	VP FTDE/OT	
Training		S / NTC		S / AWE

Live	Virtual	Constructive

D	Digital		**C**	Cost
VP	Virtual Prototype		**S**	Simulator
CM	Combat Model		**NTC**	National Training
AWE	Advanced Warfighting Exercise			Center

As indicated in the figure, the use of M&S in the functional areas occurs across all of the acquisition phases.

Just as the PM develops an acquisition strategy for the desired system, so too must the PM develop a strategy for M&S. The SSP indicates not only what M&S is required to support system acquisition, but also when the M&S should be available for use, and when and how verification, validation, and accreditation (VV&A) will be performed.

The concept of managing M&S as a resource is not always readily obvious. Typically, tools are not thought of as requiring management attention. Because of the tremendous capability of M&S to reduce cost and schedule as well as mitigate associated risk, the PM who does not actively manage M&S activities risks fielding a system that is over budget and behind schedule.

A helpful analogy in understanding why it is important to manage M&S tools is to think in terms of a do-it-yourself home project (such as building a set of storage cabinets). Anyone who has ever embarked on such a venture has a full appreciation of why the proper tools are so important. With the right tool, a daunting task can become easy. Prior to starting that home project, a set of plans is needed along with a list of required materials. The mistake many first time do-it-yourselfer's make is not realizing it is just as important to have a plan for how to use the needed tools and when to have them available. Because this is so often overlooked, time is frequently lost because the right type of tool was unavailable when needed. Work has to be interrupted to fetch the needed tool. In some cases, if prior thought had gone into identifying the best type of tool for a job (a sliding compound miter saw instead of a circular saw for instance), the job

could have been accomplished in not only less time, but also with less effort and cost.

The same holds true for M&S. A PM who takes the time to identify the best set of M&S tools that can be used to accomplish needed tasks will ultimately field a better product. M&S can be used to augment the systems developers' capabilities. M&S provides the means for conducting "what if" drills when exploring new concepts or stressing a system's performance. It can also be used to identify design flaws, thus reducing and delaying the need for a physical prototype. M&S facilitates user participation in the design process so that the fielded system has increased quality, military utility, and supportability. A PM who develops and implements a well thought-out M&S strategy will end up with an improved acquisition strategy as well as a superior product in the field.

Air Force Space Command Establishes First Space Battlelab

New Space Battlelab Will Employ Modeling and Simulation in an Operational Environment

CAPT. CLIFF D. OZMUN, U.S. AIR FORCE

FALCON AFB, COLO. A new era in warfighting was born here June 30 with the activation of the Space Battlelab, an organization dedicated to innovative space operations and concepts.

The flag of one of the Air Force's newest organizations was unfurled at the activation ceremony that was observed by Gen. Howell M. Estes III, Commander in Chief of North American Aerospace Defense Command, U.S. Space Command, and Commander of Air Force Space Command; and Col. Jeff Wenzel, the battlelab's commander.

"The Space Battlelab will be developing and examining new ways to make space an integral part, not only of what our operational warfighters do, but our logisticians, our communicators, our intelligence agencies, and eventually the American public at large," said Estes. Citing the Global Positioning System as an example, Estes said the concepts the Space Battlelab develops may result in spin-off technologies that will have application to the everyday lives of all American citizens, long after the concepts begin to serve the military's needs.

The post-Cold War environment created several new realities for the military, realities this battlelab was created to address. Foremost among those realities was the fact that Defense Department budgets and personnel numbers were significantly reduced. Combined with this was the rapid advancement

The Space Battlelab...
dedicated to innovative
space operations
and concepts.
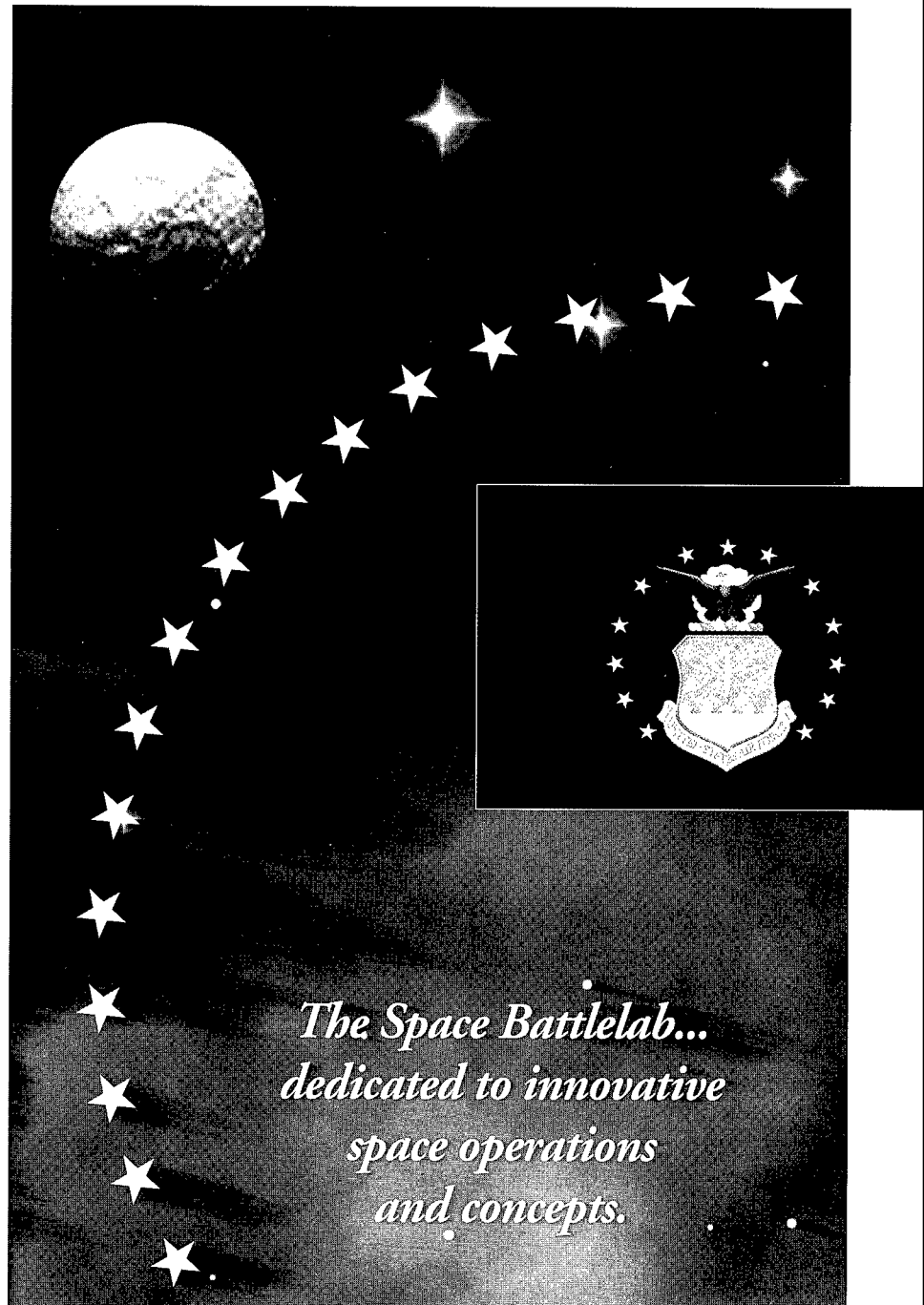
of technology development and the challenges this advancement poses for upgrading military capabilities. And finally, commercial business ventures have now replaced the military as drivers of many high-technology markets.

"The nature of the combat environment today is changing," said Wenzel. "Technology is moving faster than it ever has before. We don't know if we're applying technology that our country develops to our warfighting the way that we could or should." The military is having to fight in new, nontraditional environments such as Somalia, Bosnia, and Haiti.

"So we need to be able to change and do things differently than the way we've done them before," said Wenzel. The Space Battlelab facilitates ideas and innovation, the kind of innovation that led to many of the Air Force's historical successes.

Wenzel said the battlelab is not a "laboratory," in the classic sense. There are no test tubes, beakers or Bunsen burners. "I'd call us an innovation cell," he said.

"As we stand here today, anticipating the turn of the century, on the brink of an evolving air and space force to a space and air force, activating the first battlelab for space, we are indeed living in interesting times," said Estes. In fact, Estes said, many historic parallels exist between the birth of aviation and the birth of the space battlelab. The Wright brothers had a dream, a concept which became a reality and the foundation for the U.S. Air Force.

"These men were visionaries, visionaries whose concepts resulted in technological development which changed the course of human events," Estes said. "The need for our air and space forces are evolving and moving forward into the future at a very, very fast pace."

The Space Battlelab is one of six battlelabs founded by the Air Force whose missions are to advance the Air

> *"As the battlelabs begin to work together, the synergistic effects will lead us all into the next century and beyond, not only changing the nature of conflict but more importantly, providing new ways to make the world a safer place for all who inhabit the Earth."*

Force Core Competencies of: Air and Space Superiority, Global Attack, Precision Engagement, Information Superiority, Rapid Global Mobility, and Agile Combat Support. The battlelabs will rely on field innovation to identify ways to advance these core competencies.

"As the battlelabs begin to work together, the synergistic effects will lead us all into the next century and beyond, not only changing the nature of conflict but more importantly, providing new ways to make the world a safer place for all who inhabit the Earth," Estes said.

"We are an air and space force that embraces change in technology, and the Space Battlelab will lead the way in innovations that haven't been considered yet," said Estes. The Space Battlelab will be small and will focus on innovation for space-related Air Force Operations. It will employ field ingenuity, modeling and simulation, and existing capabilities in an operational environment in order to accomplish the Air Force mission. "The Space Battlelab offers our command and the air and space forces at large the opportunity to consider concepts that will not only further integrate space into our

land, sea and air forces, but go beyond traditional methods of power protection, and most importantly, further develop space itself," Estes said.

The Space Battlelab will report directly to the Space Warfare Center here, another cutting-edge organization dedicated to marrying space-based capabilities with warfighter needs.

The battlelab will develop concepts and rapidly evaluate their potential. "We're going to take ideas from all over the Air Force and Space Command," said Wenzel. He adds that when the battlelab gets an idea that will help the Air Force execute a combat mission more efficiently, the concept will be tested and evaluated. "And then we'll run with it."

To illustrate the importance of these battlelabs, successfully demonstrated battlelab initiatives may result in changes to Air Force doctrine, new statements of combat mission needs, new Air Force requirements, reprogramming of funds, demonstrations of advanced technology concepts, or changes to ongoing or future acquisitions.

"This, of course, is the 50th anniversary year of our Air Force. And we can now see the beginnings of the space and air force of the future," said Estes. "As we embark on the next 50 years, the Space Battlelab will play a pivotal role in developing and evaluating concepts that will chart the future of military space."

The other five battlelabs are the Air Expeditionary Force Battlelab at Mountain Home AFB, Idaho; Battle Management Battlelab at Hurlburt Field, Fla.; Unmanned Air Vehicle Battlelab at Eglin AFB, Fla.; Force Protection Battlelab at Lackland AFB, Texas; and the Information Warfare Battlelab at Kelly AFB, Texas. All six battlelabs were operational by July 1, 1997.

Editor's Note: Ozmun is with the 50th Space Wing Public Affairs Office, Falcon AFB, Colo.

Modeling And Simulation – A New Role for the Operational Tester

Every Ideal Test is Tempered with Constraints

STEVEN K. WHITEHEAD

The traditional role of the independent operational tester has been as the fleet users' representative in the acquisition process. It is the operational tester's responsibility to independently determine the operational effectiveness and operational suitability of a new, improved, or upgraded system prior to introduction to the fleet. This determination is achieved by testing a production representative system, in the operational environment, against the expected threat, and using fleet representative operators and maintainers. That has been the mission of Commander, Operational Test and Evaluation Force (COMOPTEVFOR) for over 50 years.

Levels of OT&E

There are many different levels of operational test and evaluation (OT&E) conducted by COMOPTEVFOR, including developmental assist (DT Assist), early operational assessment (EOA), operational assessment (OA), initial operational test (IOT), software qualification testing (SQT), operational evaluation (OPEVAL), verification of correction of deficiency (VCD), and follow-on operational testing and evaluation (FOT&E), all of which, with the exception of DT Assist, will result in a recommendation from COMOPTEVFOR on fleet utilization or continued development. Each of these levels of operational testing (OT) involve varying levels of operational realism/fidelity, and therefore will result in varying levels of conclu-
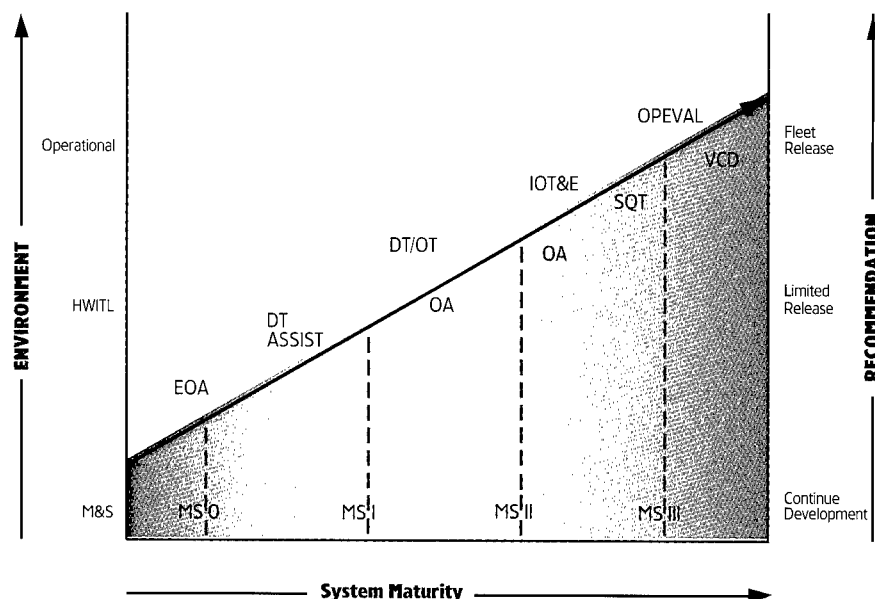
Fleet Utilization/Release Recommendation

sions with regard to operational effectiveness and suitability as well as a fleet release recommendation. The simple rule of thumb is: The level of confidence in projected system performance during actual fleet operations is directly proportional to the fidelity of the scenario in which the test is conducted with regard to the operating environment, including both the physical environment and system maturity. The chart graphically depicts this rule of thumb.

There are two fundamental considerations for the operational tester that apply to both real-world OT and *modeling and simulation.*

Fidelity to operational environment. How representative to the operational environment is the scenario under which the data are collected? Given the constraints placed upon even real-world OT, actual test scenarios are only "representative" of how the system will be employed. The level of fidelity of a model or simulation can be compared to the level of fidelity of any real-world operational test. In real-world OT, it is not possible to conduct a test in actual combat conditions; therefore, some level of replication of actual combat is planned with as many of the variables and limitations identified as possible. This process is accepted because we test to an accept-

Whitehead is the Technical Director, Commander, U.S. Navy Operational Test and Evaluation Force (COMOPTEVFOR), Norfolk, Va.

able level of confidence, with the understanding that every ideal test is tempered with constraints such as funding, resource availability, technology, etc. We continually leverage all data sources to ensure the maximum use of available resources. All of this brings us to an operational test that is less than the ideal, and this is accepted and rational. Since OT is representative of fleet operations, there are always tradeoffs and resulting limitations to the scope of testing. It is anticipated that *modeling and simulation* will be an effective tool in examining those areas that have, in the past, constrained OT&E.

System maturity. Where in the development/procurement cycle is the system? Early on in the acquisition/development cycle, it is not expected that systems will be able to fully meet all of their operational requirements. Systems, as well as supporting *modeling and simulation*, are expected to mature over time, in parallel, with each successive operational test building upon the information collected previously.

It is anticipated that models and simulations used for system design will evolve and support those for initial testing, and so on. COMOPTEVFOR, working in parallel with the system developers and *modeling and simulation* proponents, will gain additional insight into how the proposed system is planned to meet its operational requirements.

Rational Interpretation and Implementation

There is no argument that *modeling and simulation* has the potential to be a highly effective and efficient tool in support of the entire DoD acquisition process and especially OT&E. It is the rational implementation of that tool which is required. The specific limiting uses of *modeling and simulation* are delineated in DoDD 5000.2-R, and their use is recommended for all Major Defense Acquisition Programs (MDAP) and Major Automated Information Systems (MAIS) programs. Common sense dictates that this approach also applies to other than

MDAPs and MAIS; however, it is the interpretation and implementation of this directive where common sense plays the biggest role. The extent to which *modeling and simulation* can be used to supplement OT is generally a negotiation between the model proponent and the operational tester, and this is where the new role for the operational tester is created.

In the traditional role, the operational tester did not set requirements or thresholds for the system to be tested and evaluated, and this remains the role for systems under test. In the case of *modeling and simulation*, where users of the model/simulator are the operational testers, it is they who must aid in the definition of the performance output requirements of the model/simulation. It is the operational testers who must be satisfied with the level of validation and fidelity, as the users, to recommend accreditation of the model/simulation based on that level of satisfaction.

The directives and instructions recommending consideration of the use of *modeling and simulation* do not prescribe specifically where *modeling and simulation* should be employed. They do, however, specifically state that *modeling and simulation* cannot be used exclusively to support beyond low rate initial production decisions. Directives and instructions also do not specifically prescribe any limiting amount of developmental data that can be used to supplement OT. The decision as to the amount of "other" data (i.e., data not directly collected from an independent operational test) that are used to evaluate a system by the operational tester is the decision of the operational tester, and this includes the amount of *modeling and simulation* used to supplement operational data.

Use of Modeling and Simulation in T&E and OT

In support of the Navy and DoD Vision for the use of *modeling and simulation* in T&E, COMOPTEVFOR will continue to work to implement the advancements and improvements of

the T&E process by applying *modeling and simulation* technology to —

- improve product quality and functionality;

- reduce technical risk and program cost;

- enhance performance assessments; and

- make comprehensive T&E more affordable.

To accomplish this, COMOPTEVFOR will endeavor to make significant contributions to acquisition streamlining by —

- providing test environments that can reduce acquisition life-cycle costs and time with no increase in acceptable risk; and

- enabling the developmental and operational testers to participate in the model-test-model process and integrated product team without compromising the operational tester's independence.

Specifically, one method of accomplishing this is by leveraging off of the extensive technical capabilities/knowledge within program offices to assist in OT. The use of program office resources in the understanding of system design and implementation of operational requirements will in no way compromise the independence of the operational tester.

COMOPTEVFOR has, over the past year, been highly active in exploring more efficient ways in which to use modeling and simulation to supplement OT. The majority of the endeavors to date have been in accrediting hardware/human-in-the-loop laboratories and engineering facilities. Accreditation by COMOPTEVFOR is application and use-specific. In general, verification and validation (V&V) data will be reusable to support accreditation decisions for other uses of a model or simulation. However, V&V data are also gathered against specific

rather than general requirements, and may need to be amplified for a particular application. The information needed for accreditation, and the underlying V&V processes and procedures, will vary depending upon the nature and scope of the simulation. In particular, verification, validation, and accreditation (VV&A) of federations and their associated federates is a challenge that still needs to be addressed. The VV&A agents must begin early in the development process to identify the VV&A requirements for federation models.

Involve Operational Testers Early

As Navy operational testers are not software or systems engineers but rather are operators with widely varying degrees of technical education, it is imperative that the operational testers be involved early and are sufficiently educated to understand the basic principles and uses of *modeling and simulation*. To this end, it was necessary for COMOPTEVFOR to develop a list of fundamental questions for the operational test director (OTD). The answers to these questions will assist the OTD in establishing a baseline knowledge level with regard to each modeling/simulation development and utilization.

Q
What is the reason for the initial development of the model, and what is its similarity to the current application? Is there a requirements document for the model and a software design specification for the initial implementation and for any modifications?

Q
What is the developer's reputation, Software Engineering Institute rating, and model development experience? Can the developer provide metrics on software maturity, complexity, requirements traceability, design stability, and depth and breadth of testing?

Q
What are the hardware, software, personnel, data, and security requirements associated with using the model? What is the

schedule for model development and model V&V activities?

Q
What is the configuration management (CM) status of the model and its associated databases? Does the CM process have these four characteristics: (1) a well-defined baseline; (2) standard baseline test cases and data sets; (3) well-defined, coordinated, and supported testing program; and (4) current, thorough documentation?

Q
What V&V has been accomplished, or is planned, to establish model credibility?

Q
What modeling and simulation documentation is available (types of documentation, detail, accuracy, and currency)?

Q
What are the known limitations or problems with the model? (A good configuration management system has such a list readily available.)

Operational Testers do not "test" or verify models or simulations. They are, however, closely involved in the validation process. The Draft COMOPTEVFORINST 5000.X establishes procedures on the use of models to support OT&E and describes the information necessary for accreditation by COMOPTEVFOR. It is the model proponent's responsibility, in conjunction with COMOPTEVFOR, to –

- develop plans to use *modeling and simulation* in OT, which includes a description of the system, test objectives, *modeling and simulation* objectives, and a test schedule;

- develop V&V to support accreditation for the application; and

- provide a V&V plan, V&V reports, and other support documentation, such as model user guides, analyst notebooks, configuration management plans, software development policy and procedures, and software process review reports.

The accreditation package contains at least the minimum documentation required by DoD 5000.59P and Draft SECNAVINST 5200.XX.

Conclusions

As a tool to supplement for limited assets, it is COMOPTEVFOR policy that the *modeling and simulation* will not replace actual operational assets. *Modeling and simulation* is a tool to more effectively and efficiently employ the limited assets available. *Modeling and simulation* should not be used to extrapolate system performance. The Navy's Draft Test and Evaluation Modeling and Simulation Master Plan includes the documentation requirements, with formats, for the use of *modeling and simulation* in OT. The accreditation plan format, accreditation report format, and verification and validation report format are suggested formats and can be tailored to each application.

While OT must remain "operational," *modeling and simulation* can be used very successfully in test planning, rehearsals, training, post-test analysis, and in limited cases, the test itself. Specific guidance on when *modeling and simulation* can be successfully applied cannot be a cookbook approach. Each program must examine the testing areas that could be more effectively executed using *modeling and simulation*. In some cases, the use of *modeling and simulation* may be more expensive than traditional testing, but yield results that would be impossible to obtain using traditional testing. In all cases, the decision makers and the operational testers must assess the value added by *modeling and simulation* and determine the most cost-effective testing plan.

Operational testers must continue to participate in the *modeling and simulation* initiative that will form the basis for future use of emerging technologies to ensure OT&E specific issues are incorporated. Additionally, an aggressive effort must be made to identify and use the full capability of *modeling and simulation* within OT&E.

SPY-1D(V) Models and Simulations Support Operational Testing in a Remote New Jersey Cornfield

PEO, Developer, Operational Tester Combination Works Smarter, Placing Best Technology in Warfighters' Hands

LT. CMDR. HARRY M. CROYDER, U.S. NAVY
CMDR. WILLIAM P. ERVIN, U.S. NAVY • DR. DAVID S. MAZEL

Accredited models and simulations make land-based testing of the SPY-1 radar family more credible than ever before. This article is about one such operational radar test, conducted in a remote New Jersey cornfield.

Also in this article, we explain the verification, validation, and accreditation of the SPY-1D(V) program models and simulations, and how this process not only ensures the proper use of high-fidelity, thoroughly understood models and simulations, but also enhances the realism and credibility of operational testing. Further, we describe development and application of this accreditation process in support of the recent SPY-1D(V) radar test; focus on the managerial versus the technical aspect of this process; and present potentially useful ideas to organizations involved with modeling and simulation in the operational test and evaluation arena.

Navy's SPY-1D(V) Strategy Decision

In 1994, the Navy faced an important acquisition strategy decision – important because the AEGIS SPY radar system is completely integrated into the
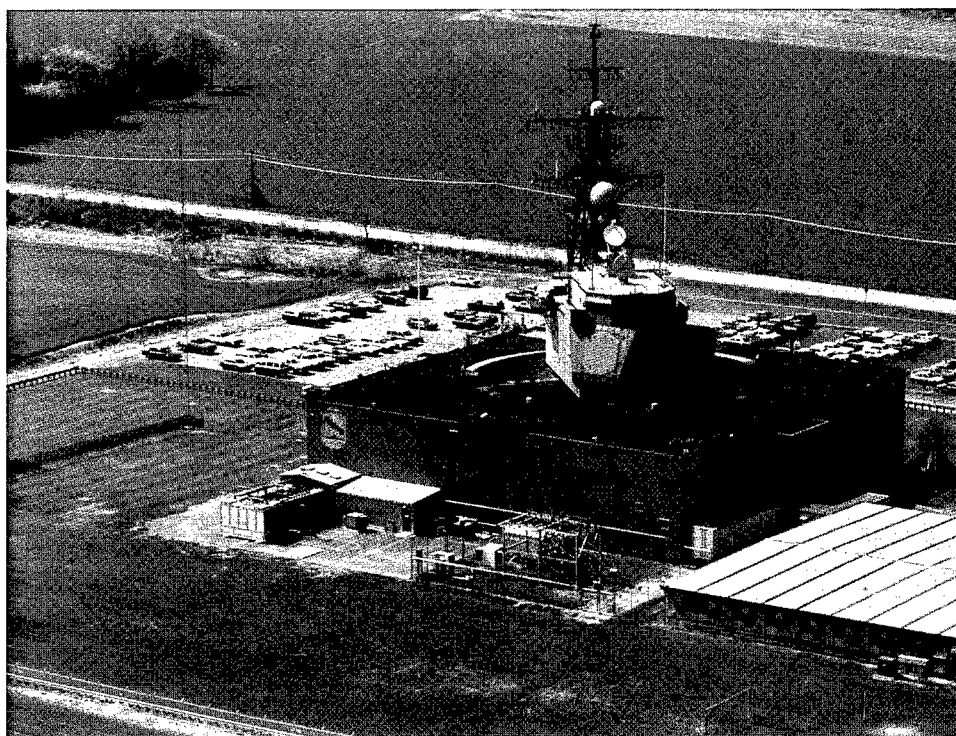
AEGIS COMBAT SYSTEM ENGINEERING DEVELOPMENT SITE (CSEDS), HOME OF THE "CORNFIELD CRUISER"

Photo courtesy Unisys Corporation

AEGIS ship, and it takes five years to build a ship. Two options emerged for consideration:

Option 1. Produce and install a single SPY-1D(V) radar in a new construction DDG 51-class ship.

Option 2. Use the land-based test site to test operationally the engineering development model of the SPY-1D(V) radar.

Croyder is a surface warfare officer with over 19 years of service. He is currently assigned to Commander, Operational Test and Evaluation Force (COMOPTEVFOR), Norfolk, Va., as the operational test director for all AEGIS programs. Ervin is a surface warfare officer, currently assigned as section head for surface-to-air missiles at COMOPTEVFOR. Mazel is a research analyst for The CNA Corporation, Center for Naval Analyses. He holds a Ph.D. and is currently on temporary assignment to COMOPTEVFOR.

Option 1 would cause the interruption of SPY-1D radar production and create a unique operational ship for the sole purpose of at-sea testing to support a low-rate initial production acquisition decision. This option would have the advantage of testing in the operational environment, but the disadvantage of delaying fleet introduction of SPY-1D(V) radars for up to five years and incurring additional costs for creating a unique asset and conducting two SPY-1D(V) production starts versus one.

Option 2 called for land-based testing to support a low-rate initial production acquisition decision without interfering with current radar/ship produc-

tion. This option had the advantage of making the acquisition decision in 1996 vice 2003-plus, but the disadvantage of testing in a land-based operating environment.

Key to the Navy's SPY-1D(V) strategy decision was a determination that land-based testing was adequate to support a low-rate initial production decision. Toward that end, the Navy planned to conduct this land-based testing at its Combat Systems Engineering Development Site (CSEDS) in Moorestown, New Jersey. Due to its land-locked location, CSEDS' characteristics are vastly different from any shipboard environment, and those differences remained to be assessed.

The CSEDS facility is 50 miles from the Atlantic Ocean in a location that prohibits low-flying aircraft and severely restricts chaff and electronic jamming activities. Any test scenarios involving fixed wing aircraft, helicopters, chaff, and jamming must be

conducted in areas that do not interfere with commercial airways, nearby subdivisions, or local farm animals. Site characteristics bear little resemblance to the at-sea operating environment of dynamic sea clutter, multipath low elevation propagation, and pitching and yawing conditions a radar will operate in when installed in a Navy ship. The testing methods for SPY-1D(V)'s new capabilities were all adversely impacted by CSEDS' site limitations.

To help make the test adequacy determination, the Assistant Secretary of the Navy (Research, Development, and Acquisition) (ASN[RDA]) commissioned an independent advisory committee to investigate the SPY-1D(V)'s capabilities and CSEDS characteristics. After assessing risk mitigation, technical risks, and test adequacy, this independent committee concluded that, with the use of models and simulations, the radar could be tested well enough to support the low-rate initial production decision. Based in part on this conclusion, ASN(RDA) chose Option 2 and signed an Acquisition Decision Memorandum authorizing land-based operational testing at CSEDS.

ASN(RDA)'s decision complemented the growing trend within the Department of Defense (DoD) to find alternatives for the ever-increasing costs and rapidly shrinking resources associated with test and evaluation requirements, particularly requirements associated with field tests. One alternative is the use of models and simulations. DoD has moved toward models and simulations as a way to cut expens-

SPY-1D(V) RADAR. THE AEGIS SPY RADAR SYSTEM IS COMPLETELY INTEGRATED INTO THE AEGIS DESTROYER FLEET.
U.S. Navy photo
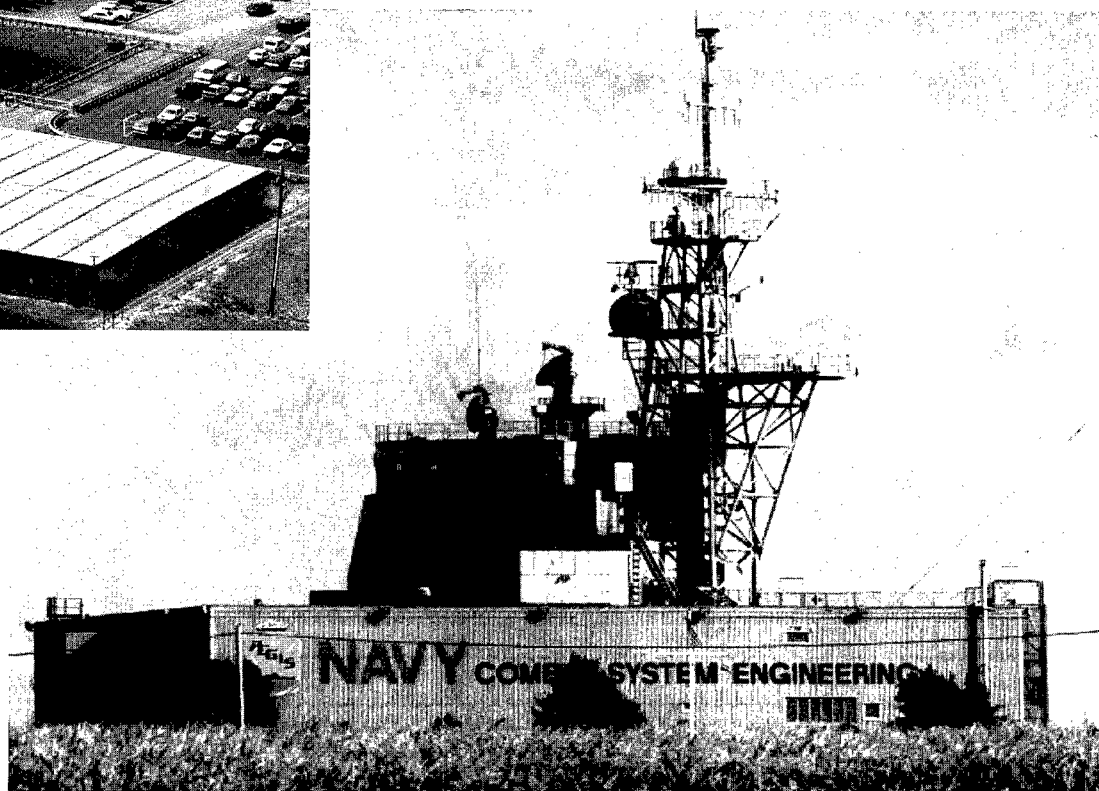
es in developmental and operational testing. Real-world assets such as very small targets, aircraft services, and missile firings are becoming increasingly scarce and expensive. Some acquisition programs have been using models and simulations for years and have established methodologies for conducting verification and validation.

The Verification, Validation, and Accreditation Process

To the Navy's independent test agency — Commander, Operational Test and Evaluation Force (COMOPTEVFOR) — the idea of using models and simulations instead of actual field operations to validate at-sea systems' performance was a departure from traditionally accepted testing methodology. To the COMOPTEVFOR staff, who experienced and well understood at-sea realities, the modeling of the SPY-1D(V)'s new capabilities for operational applications had little credibility because CSEDS is land-locked.

COMOPTEVFOR supported the move toward models and simulations by developing a command concept and procedure that outlined how models and simulations fits into operational testing. Involving a process called verification, validation, and accreditation, this concept calls for a program executive office to verify and validate all the models and simulations it requires to perform necessary developmental and engineering tests. Ideally, the verification and validation process should satisfy the program executive office that the selected models and simulations function as expected. When the program executive office is satisfied, it formally accepts the models and simulations for use in developmental testing. This formal acceptance is called certification, and is the measure of the program office's confidence in its model. After certification, the program executive office directs the model's use in the developmental test strategy. If the models and simulations will be used in an operational test, COMOPTEVFOR must accredit the models and simulations for a specific purpose

within that test. Accreditation is the COMOPTEVFOR formal acceptance of the validated models and simulations. COMOPTEVFOR always considers certification a prerequisite to accreditation.

Step 1. The Simulation Management Plan (SMP). Neither the Program Executive Office Surface Combatants-AEGIS Program (PEO SC-AP) nor COMOPTEVFOR possessed the experience or the infrastructure to support any of the new models and simulations initiatives, including verification, validation, and accreditation. Some of the basic concepts were there such as certification and accreditation, but few of the real-world mechanics. Those mechanics had to be created.

As the first step, we found a working models and simulations organization. As a result of using models and simulations for years, the Tomahawk Cruise Missile Program possessed practical experience, which it willingly shared. The PEO SC-AP and COMOPTEVFOR staff members, however, faced the daunting task of mastering the Tomahawk methodology; the COMOPTEVFOR verification, validation, and accreditation instruction; the program executive office and COMOPTEVFOR goals; and the time and financial constraints on the entire process. Once they digested all these elements, the program executive office and COMOPTEVFOR staffs jointly authored a verification, validation, and accreditation plan, called the SPY-1D(V) Radar System DT/OT Simulation Management Plan (SMP).

First SMP Component – The Goals
The establishment of goals by each participating office is the first component of the SMP. Once established, each office must clearly understand the goals of all other offices and jointly design a framework that will mutually support the achievement of all goals.

Accreditation of those models that supported its mission — the operational test — was COMOPTEVFOR's

primary goal. In this case, accreditation required seven models/simulations/simulators/stimulations. Only after a thorough review of the verification and validation process to determine the fidelity of each model in supporting operational testing, was accreditation awarded. Prior to accreditation, we prepared and reviewed the following required documents for each model (discussed at length in subsequent paragraphs):

- Simulation Validation Plan

- Simulation Validation Report

- Simulation Version Description Document

- Program Executive Office Certification

No requirement exists that any model must exactly replicate the real world; in other words, no model is expected to be a "perfect" empirical representation.

Alternately, one of the program executive office's major goals was the accreditation of its models and simulations. Accreditation meant that the SPY-1D(V) models and simulations were credible enough to conduct the test strategy outlined in ASN(RDA)'s Acquisition Decision Memorandum. Accreditation also meant that an outside activity reinforced the program executive office's reputation for enforcing standards. Since certification was a prerequisite to accreditation, the SMP outlined the program executive office's certification requirements as well.

Second SMP Component –
Verification and Validation Method
The other major component in the SMP is the actual verification and validation execution framework. The preferred, overarching theoretical concept of verification and validation calls for a disinterested third party to accomplish validation. This type of validation is known as independent verification and validation. For the SPY-1D(V), nei-

ther the time nor the money existed to contract such a party to independent verification and validation – all seven required models and simulations. Instead, the SMP authorized an internal verification and validation method, the use of which represented a need to mitigate any credibility risk to the program. This meant that the models and simulations developers would validate their own models with program executive office and COMOPTEVFOR oversight instead of independent verification and validation.

Again, in the interest of time and money, the SMP did not require new data collection. In other words, for certain models the developers were not tasked to acquire new empirical data to support verification and validation. New collection and analysis of atmospheric propagation, sea clutter, or live missile telemetry data was impractical. This information already existed in several places and could be used at significant time and cost savings.

Third SMP Component – Credibility
Next, PEO SC-AP and COMOPTEVFOR agreed that their staffs must maintain ruthless self-discipline to reduce risk and ensure credibility since independent verification and validation would not be used. All verification, validation, and accreditation procedures, results, and discussions would be open to outside agencies' inspection. This openness philosophy was the cornerstone of the entire effort's success.

Fourth SMP Component –
The Framework
Finally, the SMP provided the organizational structure to achieve the goals and execute the verification and validation method. This structure consisted of the Simulation Management Board (SMB) and the Simulation Control Panel (SCP). The SMP required the use of the SMB and the SCP and provided an executive summary of their functions. The SMP also described each one's membership and its role in accomplishing certification and accreditation.

SPY-1D(V) ACCREDITATION PROCESS

Determine Mutual Goals

Author Joint SMP
1. List Certification Requirements
2. List Accreditation Requirements
3. Outline VV&A Process

SCP
1. Determine V&V Approach on a Case Basis
2. Approve Developers' SVPs
3. Oversee V&V Process
4. Examine V&V Results: Fidelity, Capabilities, & Limitations

Approved SVR/SVDD — NO → Return to Developer

YES

SMB
1. Examine SCP Results
2. Determine Rigor in Process

Recommend Certification — NO → Return to SCP

YES

Certifying Authority

Certifies — NO → Return to SMB

YES → **Developmental Tests**

Accreditation Authority

Accredits — NO → Return to SMB

YES → **Operational Test**

SMP	Simulation Management Plan
VV&A	Verification, Validation, and Accreditation
SCP	Simulation Control Panel
SVR	Simulation Validation Report
SVDD	Simulation Version Description Document
SMB	Simulation Management Board

Step 2. The Simulation Control Panel (SCP). The SCP provided the working technical oversight of the verification and validation process. Its composition included mainly technical personnel, who well understood their respective models and simulations, as well as AEGIS combat system technical representatives. Part of the SCP's function was to promote a technical exchange.

The SCP – Its Membership
The SCP's chairperson was the SPY-1D(V) program manager's assistant. The co-chairperson was the COMOPTEVFOR operational test director for the SPY radar program. These two individuals directed the oversight process. It is important to note that both co-chairpersons had to be in agreement for any item to pass the SCP. Other members included technical representatives from the three companies who developed the models and simulations, namely Lockheed Martin (Government Electronic Systems) Corporation, Technology Service Corporation, and Systems Engineering Group. Additionally, the Naval Surface Warfare Center and AEGIS Technical Representative provided technical support to the program executive office chairperson, and the Center for Naval Analyses supported the COMOPTEVFOR co-chairperson.

The SCP – Its Function
As previously mentioned, the SCP's charter was to perform the working-level oversight of the verification and validation process. Toward that end, the membership devoted a good deal of time and effort to understanding and defining the seven models and simulations. When the SCP leadership believed they achieved a sufficient understanding of each model and simulation, they asked the developer to propose a verification and validation plan based on its assets and the data available. When the developer eventually submitted a proposal, the membership then discussed it at length and selected the actual process the developer would use to validate the models and simulations.

> **When the SCP leadership believed they achieved a sufficient understanding of each model and simulation, they asked the developer to propose a verification and validation plan based on its assets and the data**

Most of the early meetings centered around selecting the proper verification and validation method. Sometimes these discussions were rather frank and resulted in some strong disagreements, but fortunately the SMP did not require unanimity. Once the co-chairpersons accepted the validation proposal, the developers proceeded to write the Simulation Validation Plan. The SCP met frequently to monitor validation progress. Sometimes, of necessity, the SCP changed verification and validation procedures because the developer found a better way or discovered the current method wasn't working as planned. The SCP membership carefully reviewed validation progress and early results to ensure they met the objectives initially outlined in the SMP. As verification and validation progressed, the developers began to write the Simulation Validation Report and the Simulation Version Description Document.

The Simulation Validation Plan Groundwork. The SMP required a separate Simulation Validation Plan for each model and simulation. As previously noted, early SCP meetings centered around determining which verification and validation method to employ for each model and simulation. During those determinations and in order to author the Simulation Validation Plan, several questions remained to be answered, or at least addressed:

Is the model and simulation a model? (A model is defined as a physical, mathematical, or otherwise logical representation of a system entity, phenomenon, or process.)

Is the model and simulation a simulation? (A simulation is defined as a method for implementing a model over time, or where real-world and conceptual systems are reproduced by a model.)

For what purpose will the model and simulation be used?

What are the capabilities and limitations of each model and simulation?

What value will the model and simulation add to the operational test?

How will use of each model and simulation impact the operational tester's ability to formulate conclusions?

How does the model interoperate with the other six models?

What options exist within the time/money/data constraints to verify and validate each model?

In practice, the SCP answered some of these questions only after they approved the Simulation Validation Plan, and the interoperability issue was never completely addressed. The SCP intended the verification and validation process to be flexible. When the panel found a better way, they altered the process and sometimes changed an answer too. Once the SCP assembled sufficient information, it addressed requirements for the Simulation Validation Plan.

Two Simulation Validation Plan Requirements. The first Simulation Validation Plan requirement was the selection of the right method based on the SCP's understanding of the models and simulations . As a result, the SMP mandated that the verification and validation process use at least one of three possible methods:

• Model-to-Real-World Comparison

• Model-to-Model Comparison

• Code Analysis

For SPY-1D(V), a model-to-real-world example was the simulation that represented small radar cross-section targets. Because no real-world targets existed, the developer used the model-to-real-world simulation, attaching a physical sphere to a balloon and launching it into the air. This sphere had a known cross-section that fluctuated in the real environment. As it floated away, the SPY-1D(V) radar tracked the sphere. It also tracked a target simulation constructed with the same cross-section. Unlike the sphere, however, the target simulation possessed no cross-section fluctuating capability. We then compared the sphere's cross-section, as observed by the radar, to the simulation's cross-section as observed by the radar. Results determined the corrective action necessary to improve the simulation.

A model-to-model example was the sea clutter simulation. We used this simulation because CSEDS is a long way from the ocean. The simulation was actually a composite of two models and simulations — a mathematical model, representing the sea clutter phenomenon; and a hardware generator, which implemented the model into the system such that the radar could observe the sea clutter. Validation of the generator's implementation ability compared the mathematical model with the generator's simulation. The results initiated a plan of action.

The second requirement stipulated that the known capabilities and limitations of the models and simulations be stated. Every Simulation Validation Plan included a list of the known capabilities and limitations of its model to preclude future misunderstandings. The unforeseen benefit of this requirement was the discovery that the "known" capabilities and limitations listed in the Simulation Validation Plan were not necessarily the same ones revealed later during verification and validation.

As verification and validation progressed, the SCP began to author the next two required documents, the Simulation Validation Report and the Simulation Version Description Document.

The Simulation Validation Report
The Simulation Validation Report was the written report of results achieved during verification and validation. It contained an executive summary and a technical analysis section. Included in the Simulation Validation Report were validation details such as —

• a description of the actual validation procedure;

• a discussion of why that procedure differed from the one outlined in the Simulation Validation Plan; and

• a list of capabilities and limitations confirmed by the verification and validation. Where the

Simulation Validation Plan and Simulation Validation Report lists differed, the developer added an explanatory note.

The Simulation Version Description Document
The Simulation Version Description Document briefly described the computer program configuration management that supported the models and simulations. The developer met this SMP requirement chiefly through a related, non-accreditation event called a COMOPTEVFOR Software Quicklook. A Software Quicklook provided COMOPTEVFOR with a basic understanding of a developer's software management program.

The program executive office had previously encouraged the conduct of a Software Quicklook to promote COMOPTEVFOR's understanding of configuration management issues. A thorough review of the Quicklook confirmed that the prime developer followed accepted software configuration management procedures, further increasing COMOPTEVFOR's confidence in the models and simulations. Since the Quicklook is not a verification, validation, and accreditation requirement, it did not eliminate the accreditation requirement for a Simulation Version Description Document. However, using Quicklook data, the SCP could streamline the document.

Now verification and validation was complete. The SCP had written a Simulation Validation Plan, and the developers had executed it. The approved Simulation Validation Report contained an executive summary and the technical results. The Simulation Version Description Document was complete.

The co-chairpersons agreed to move the verification, validation, and accreditation process forward. The next step was to convene the Simulation Management Board.

Step 3. The Simulation Management Board (SMB). The SMB was a four-

member board, chaired by the SPY-1D(V) program manager. Its purpose was to recommend certification to the program executive office certifying officer. Prior to recommending certification, it evaluated the Simulation Validation Reports provided by the SCP. The SMB voting members were the chairperson, the PEO SC-AP models and simulation division head, and an AEGIS Technical Representative senior staff member. The COMOPTEVFOR Assistant Chief of Staff for Surface Warfare acted as the single, nonvoting advisory member.

The SMB acted to satisfy its membership that the verification and validation had been rigorously executed. In that regard, the board consulted the COMOPTEVFOR advisory member for the accreditation authority's perspective on the verification and validation results. When the vote was unanimous, the board forwarded a certification recommendation to the proper authority at the program executive office. When the vote was not unanimous, the board returned the product to the SCP for additional work.

The SMB/SCP membership intended their proceedings to be an open process. Interested parties from the Director, Operational Test and Evaluation and the Institute for Defense Analyses had a standing invitation to attend either board/panel. The membership extended this standing invitation for two purposes:

- Without specific DoD guidance, the SPY-1D(V) joint verification, validation, and accreditation effort was somewhat "experimental." Agencies closer to DoD might be able to provide additional perspectives on the future evolution of models and simulations policy.

- The demonstration of the rigorous, disciplined process should be witnessed and not merely advertised.

Step 4. Certification and Accreditation The SMB chairman briefed the certifying authority on the results and recommendations of the SMB. This authority certified the recommended models and simulations when convinced that the SMB had applied the requisite tough examination required by the SMP tenet of self-discipline. After the program executive office completed its internal administration, the certifying official then sent an official letter of certification to the accreditation authority.

Upon receipt, the OPTEVFOR operational test director briefed the accrediting officer on the certification letter. Included in the brief was a synopsis of the technical details from each Simulation Validation Report, including capabilities and limitations; the intended use of the models and simulations in the operational test; and an assessment of whether the ability to draw conclusions was affected. The brief also discussed how well the developer met COMOPTEVFOR requirements, and then provided recommendations. COMOPTEVFOR accredited the models and simulations when convinced that the program executive office/COMOPTEVFOR/developer working team had satisfactorily executed its charter.

The operational test director was now able to complete the test plan, obtain its approval from the appropriate authority, and conduct the operational test. Afterwards, the data analysis, final report, and test results briefings relied heavily upon the verification, validation, and accreditation effort.

Future Challenges

The successful achievement of certification and accreditation for the operational test did not mean the end of the SPY-1D(V) validation, verification, and accreditation process. As expected, the subsequent briefings provided to PEO SC-AP, COMOPTEVFOR, and the Director, Operational Test and Evaluation resulted in feedback. Thus, some new challenges arose:

- Expand existing databases by collecting new empirical real-world data.

- Refine models and simulations fidelity, such as the sea clutter mathematical model, to more closely approximate real sea clutter.

- Increase the capabilities of essential models and simulations, such as incorporating a fluctuating radar cross-section behavior in the simulated targets.

- Overcome certain limitations, such as the sea clutter generator's inability to implement fully the sea clutter model.

- Improve the verification, validation, and accreditation process.

- Investigate new models and simulations that will add value to future developmental and operational tests.

Lessons Learned

In reality, the functioning of the verification, validation, and accreditation process was not nearly as clean or linear as outlined in this article. In some cases, the developer wrote the Simulation Validation Plan and the Simulation Validation Report concurrently; for example, if a validation procedure proved impractical halfway through, and another method had to be implemented. In other cases, a model's verification and validation yielded an unexpected result. Once we found that a model intended for use displayed an undesired, less-realistic effect when compared to other industry models. Ultimately, we discarded this model and selected a substitute. For reasons like these, the SCP was educational for all its members.

We continued to assimilate lessons learned throughout the course of this verification, validation, and accreditation process. A brief description and solution for three of these lessons follow:

Lesson 1
We originally constructed the SCP as a voting body, similar in makeup to the SMB. However, at this level a simple majority vote consisting of the three developers and/or a supporting organization could theoretically override the desires of either the program executive office or COMOPTEVFOR. The SMP had obligated the program executive office chairperson and COMOPTEVFOR co-chairperson to support mutually the plan's common goals. For either individual to proceed without the complete concurrence of the other was self-defeating, regardless of developers' positions. So in practice, voting was irrelevant and ultimately eliminated; a simple agreement between chair and co-chair moved the SCP forward.

Lesson 2
Only one SCP existed for all seven models and simulations. The Tomahawk Program's original concept of one SCP per model was good, but considered impractical for SPY-1D(V) because of time and money constraints. So, each SCP meeting addressed all the concerns and problems associated with each model and simulation. As test time drew near, with much left to do, this "do-everything-at-SCP-meeting" approach failed. The SCP could not efficiently handle all the requirements of Simulation Validation Report development for seven models. Simulation Validation Plan writing turned out to be much more challenging and controversial than anticipated. The SCP eventually became so inundated, a permanent session appeared necessary.

The solution was to break up the SCP into smaller teams that each dealt with a subset of Simulation Validation Reports. This allowed the available expertise to focus more completely and exactly than before. One team's membership consisted of two Lockheed Martin experts as well as representatives from the Naval Surface Warfare Center and Center for Naval Analyses. Another team included an AEGIS Technical Representative

staffer, a Lockheed Martin engineer, and an OPTEVFOR analyst. Representation on each team also included the program executive office and COMOPTEVFOR. When a team wished to present a viable product, the membership convened the formal SCP.

Lesson 3
The honesty and integrity of all the participants in the verification and validation process was absolutely vital to its credibility. The co-chairing offices hid nothing from external observers, including some rather high-spirited controversies. One developer immediately revealed a model's limitation, newly discovered during verification and validation, that impacted unfavorably on its use. To their credit, the supporting activities focused their attention on problem solving, not just problem noting.

Conclusion
The net result of this rather involved process had several positive elements. All parties learned that a model's legacy is not sacrosanct. We uncovered preexisting, unknown capabilities and limitations that led to a more precise use of the models and simulations and a more accurate interpretation of test data. Ultimately, we achieved a high degree of confidence in the capabilities as well as the limitations of the models and simulations. The program executive office and its developers also gained fresh insight about their models and simulations and how to improve them.

And finally, COMOPTEVFOR authored an operational test plan that realistically and fairly tested the radar at CSEDS. ASN(RDA)'s acquisition strategy worked as intended, and the Navy saved a lot of time and money. Common sense and teamwork made this process viable and successful. DoD will see more of these efforts in future programs as the program office/developer/operational tester combination works smarter to place the best technology available in the hands of the warfighter.
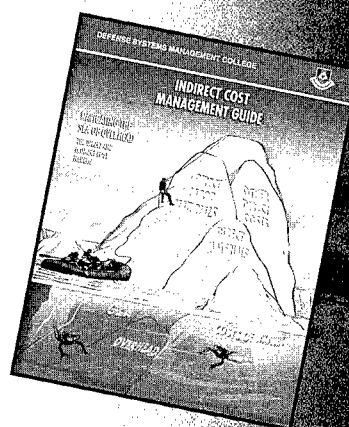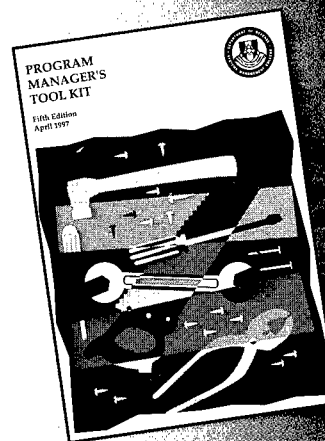
Put a Virtual Prototype on Your Desktop

An Air Force Collaborative Research and Engineering Environment for Acquisition Reform

WILLIAM K. MCQUAY

Are you tired of reading statements of work, technical specifications, proposals, and monthly reports? Have you asked yourself, what does this proposal really mean? What is the contractor actually saying, or more importantly, what will the deliverable really be able to do? Or perhaps you've indulged in a little wishful thinking: If I could only reach out and touch the new system before it exists and do a

VIRTUAL REALITY BATTLEROOM FOR THE JOINT SYNTHETIC BATTLESPACE — A "VIRTUAL PHOTO" OF A "VIRTUAL FACILITY." AN ARTIST'S CONCEPT OF THE IMMERSION THEATRE TO DEMONSTRATE FUTURE TECHNOLOGY AND WEAPONS SYSTEMS USING SIMULATION AND VISUALIZATION. THE PHOTO IS ACTUALLY A DIGITAL ENHANCEMENT OF TWO PHOTOS DEPICTING THE INSIDE OF THE DoD WARBREAKER FACILITY IN WASHINGTON, D.C.; THE FACES REPRESENT PEOPLE WHO ACTUALLY WORK AT WRIGHT LABORATORY.

McQuay is Chief, Simulation Technology Branch, System Concepts and Simulation Division, Avionics Directorate, U.S. Air Force Wright Laboratory, Wright-Patterson Air Force Base, Ohio. He directs the Electronic Concepts Simulation Research Laboratory and has over 25 years' experience in research for advanced simulation technology. McQuay currently chairs an Avionics Directorate Integrated Product Team, which is defining and implementing a Collaborative Engineering Environment (CEE) for laboratory-wide use and application of virtual prototyping.

ing (CVP). Any definition of CVP must encompass all of the following characteristics:

CVP is the application of advanced information systems technology in design, modeling, simulation, analysis, manufacturing, testing, and logistics to support life-cycle development of a system in a geographically distributed electronic environment.

Its use throughout DoD is consistent with current acquisition trends in the Department as well as the commercial sector (Figure 1).

Acquisition Reform and the Joint Synthetic Battlespace — Made Personal

DoD has implemented significant changes in how it buys weapon systems. The new emphasis is on concurrent engineering with Integrated Product and Process Development (IPPD) and collaboration with Integrated Product Teams (IPT). The new DoD vision includes Simulation Based Acquisition, a process supported by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs.

To be competitive in their fields, throughout the commercial sector world-class companies in the automotive, electronics, aircraft, and heavy equipment manufacturing areas use CVP and collaborative engineering for requirements, analysis, and design. You, as a program manager, will be working with companies that use these technologies to design their products. As partners in developing DoD products, these companies will be applying the best industry

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"virtual test drive" now, before I invest extensive resources in their concept. How do I put this in terms that all members of my acquisition team can understand? Under Acquisition Reform, as a program manager I only have *insight and not oversight* of my contractor. How do I get insight into the contractor's effort when I have less people and smaller budgets?

Help Is On the Way

Good news — help is on the way. Some innovative uses of simulation and information technologies will bring technical and program management data in a comprehensible format to a personal computer near you: desktop virtual prototyping and collaborative engineering. Changes in simulation and information technology now allow computer engineers to create computer models of conceptual hardware systems prior to building the actual hardware. The collaborative development of a digital computer model in parallel with the hardware is called Collaborative Virtual Prototyp-

> **"** *Changes in simulation and information technology now allow computer engineers to create computer models of conceptual hardware systems prior to building the actual hardware.* **"**

FIGURE 1. Simulation Based Acquisition

**Acquisition Reform Brings a Paradigm Change
IPPD and More Concurrency**

Traditional Sequential Acquisition

S&T | Concept Exploration | Dem-Val | Engineering & Manufacturing Dev. | Production | Deployment | Support

Collaboration in Simulation Based Acquisition

MIL LAB & INDUSTRY RSCH

SCIENCE & TECHNOLOGY BASE

VIRTUAL ENGINEERING AND DESIGN

CONCEPT DEFINITION → MISSION EFFECTIVENESS / SURVIVABILITY / MISSION OUTCOMES

DEMONSTRATION AND VALIDATION → SYSTEM EFFECTIVENESS / SYSTEM CAPABILITIES → VIRTUAL FLYOFFS

ENGINEERING AND MANUFACTURING DEVELOPMENT → SUBSYSTEM DEFINITION / INTEGRATION OF SUBSYSTEMS / SYSTEM PERFORMANCE → GO DIRECTLY TO PRODUCTION

PRODUCTION AND DEPLOYMENT → INTERACTIVE EMBEDDED TRAINING → OPERATIONS & MAINTENANCE

- Virtual Prototyping
- Virtual Manufacturing
- Virtual Test Ranges
- Compress the Life Cycle - Parallel Phases
- Update Key Assumptions Midstream - Technical, Cost, Schedule
- Federate the Players - Labs, SPO, Industry

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practices to your work, and you will need to collaborate with them.

Today, a commercial-sector program manager can turn on a personal computer (PC) on the desktop, check E-mail, and then look at the status of the program, — a completely paperless, electronic review. That same program manager can distribute solicitations electronically, and receive return proposals by the same mode. Along with the standard full text descriptions of the technical task in their return proposals, contractors can also submit a digital model of the concept or design.

The program manager's technical evaluation team can look at an electronic representation of the proposal in the form of a computer model. The model then becomes part of an electronic design and a simulatable specification for the system. Further, the technical team can also "what if" — hypothesize uses of the system and run excursions on competing versions of the same concept or design.

In the commercial sector, a virtual prototype of a car or a plane allows design teams to walk through the virtual prototype to see how the components are changing. The virtual prototype serves as a common frame of reference for the designers, engineers, and managers. It allows you as the program manager, to establish a level playing field for consistent comparisons among alternative concepts and designs. Ideally, CVP provides the insight you need into what your contractor is doing.

Even earlier in the acquisition process, the program or technical manager can work with the user to define requirements using a virtual prototype. Historically, program requirements are difficult to quantify and verbalize. Users are able to state what they don't want much easier than describing what they do want. A simulation model developed in parallel with the hardware or technology development allows scientists, engineers, or end users to refine system requirements early in the engi-

neering process. The users then become an integral part of the design process. Ultimately, when program managers follow IPPD procedures and bring users into the design process, commercial-sector applications show a significant decrease in development time. As we extend this approach to military acquisition, the Air Force Battlelabs will allow the operational commands to do a "virtual test drive" of new weapon concepts and provide feedback to the acquisition community.

Within the Air Force, we envision an integrated, common modeling and simulation (M&S) environment that will be accessed by analysts, warfighters, developers, and testers supporting the range of Air Force tasks, from determining requirements through conducting operations. The key concept in the Air Force M&S vision is the Joint Synthetic Battlespace — an integrated M&S environment where simulations extend from high-level aggregate models to detailed engineering

models, from pilots in live aircraft and simulators to hardware components and laboratory test beds.

Your desktop PC will be your acquisition portal into the Joint Synthetic Battlespace. During requirements definition phase, you will be immersed into a synthetic environment — a two- or three-dimensional wargame where the military worth of the proposed concept can be evaluated with realistic scenarios and locales. Such a system allows the user to selectively choose the level of detail needed for the task at hand, draw on distant resources, and easily "plug-and-play" computer simulations, manned simulators, and live hardware to create any needed simulation environment. Demonstrations of a future system's military worth will be conducted in the synthetic environment represented by the Joint Battlespace. More than just acquisition — analysts, researchers, decision makers, and warfighters must be able to "plug in" to a common bat-

tlespace from their desks, simulators, or crew stations in order to assess, develop, train, or conduct warfighting.

Your industry counterpart has long been driven by cost as the bottom line. Under Acquisition Reform, DoD will

> " *Your desktop PC will be your acquisition portal into the Joint Synthetic Battlespace.* "

make buy decisions on life cycle-cost performance trade studies where cost is an independent variable. The future Air Force Collaborative Engineering Environment (CEE) will have constraint-based analysis tools to aid in early, high-level concept trade studies for cost of function and cost of performance for various alternative technologies.

A virtual prototype allows the engineer to see the impact of design changes. Trade studies using the model can then be performed throughout development as an essential part of the systems engineering process.

A Collaborative Research and Engineering Environment Near You

Two of the most significant, technologically advanced programs are the Avionics CEE development project being conducted at the Avionics Directorate, Wright Laboratory (Figure 2); and the advanced research underway at the Defense Advanced Research Projects Agency (DARPA) Simulation Based Design (SBD) program. The Avionics Directorate has initiated a program to develop and exploit collaborative engineering technologies and implement a CEE to enhance productivity by advancing avionics collaborative virtual prototyping processes. It will build on the significant commercial technology base existing for electronic systems design, DARPA's SBD initiative, and other commercial/ industry information and modeling standards and best practices.

Collaborative Engineering and Virtual Prototyping is the application of advanced distributed M&S and engineering tools in an integrated environment to support technology development, system design, performance, cost, and producibility trade-off analyses throughout the entire product and system engineering life cycle. As such, it enables all members of an IPPD to continuously interact through electronic modeling and data interchange; increases insight into life-cycle concerns; permits earlier testing and

FIGURE 2. **CEE Built on the DARPA SBD Framework**

Cost Tools

3D Visualization

Legacy Product Catalog

Simulation

Smart Product Model

Smart Product Catalog

Work Flow Tools

Common Database

Requirement Tools

Commercial Tools

Legacy Engineering Tools
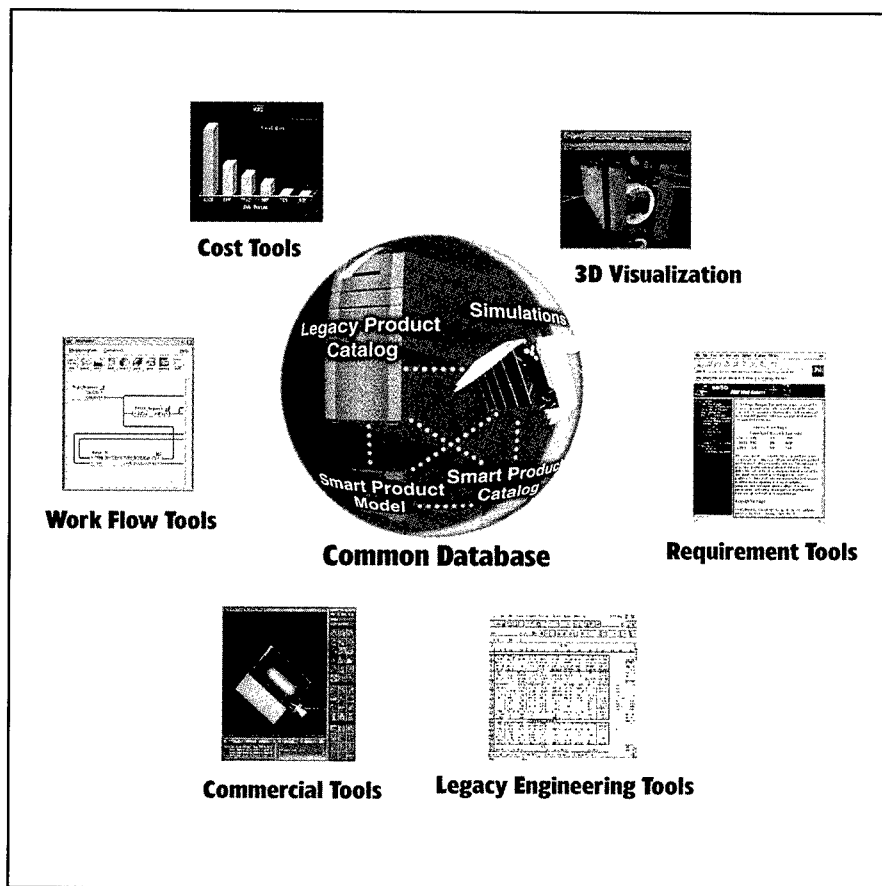
experimentation through virtual test ranges; and accelerates physical production through process optimization using virtual factories.

Additionally, Collaborative Engineering simulations, with integral product and process models, will permit engineers to obtain detailed knowledge earlier in the conceptual and preliminary design phases where it can have the most influence on life-cycle cost. More emphasis will be placed on the collaborative development of virtual prototypes of key technology products to demonstrate their military effectiveness and worth in an *integrated systems/mission environment*.

As downsizing trends continue in both defense and industry, the military and commercial laboratories will increasingly depend on other organizations for key technologies to integrate into systems. Additionally, increasing demands will be placed on technology to facilitate more efficient,

effective collaboration of widely dispersed personnel across many different application domains in order to solve complex problems and accomplish difficult tasks.

As an initial response, CVP meets the demand for technical assistance and provides the infrastructure to support these new acquisition requirements. It will also assist in the breakdown of technology stovepipes and become the construct for communication of technologies between domains.

CVP can be implemented in many organizational structures. Traditional hierarchical workplaces, concurrent engineering environments, and work groups focused on rapid prototyping are a few examples. Implementation of a CVP system requires attention to the necessary enabling technologies and supporting infrastructure. A crucial part of a CVP system implementation is educating personnel on how CVP can meet customer, organizational,

and individual goals as well as decrease time-to-market, lower life-cycle costs, and improve product quality.

Historically, 80 percent of the development costs and 70 percent of a product's life-cycle cost are determined during conceptual design. As the program moves from conceptual design into engineering and manufacturing development, the ability to substantially influence life-cycle costs diminishes. The freedom to make design changes decreases as the knowledge about the system design increases. In other words, a progression from soft to hard information occurs as the system moves from the conceptual phase to the detailed design phase.

CVP can move the knowledge curve to the left and increase the hard information available in the early stages of design. This improvement in the quality of information should benefit the acceleration of the technology maturation and ultimately facilitate

FIGURE 3. **Multiple Views in Collaboration**
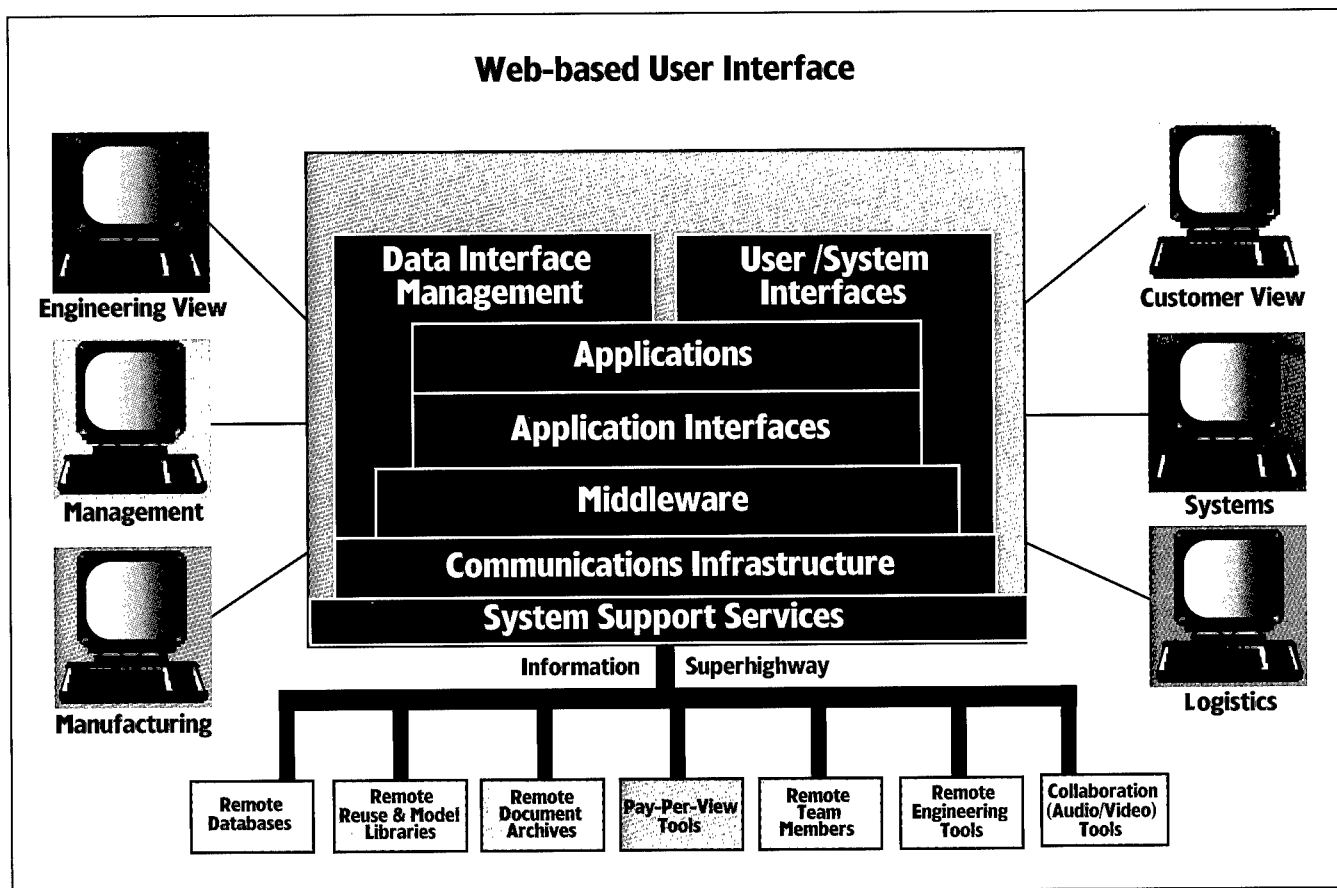
technology transition. The end result should be designs completed in less time and at less cost.

The use of M&S in the design, development, and distribution of products is not a new concept or idea. The DoD and industry have been using virtual prototyping within many of their individual functional departments and organizations for many years. However, these individual *stovepipe* groups of functionality have not interacted with each other in an effective way and have oftentimes duplicated functionality.

A CVP system provides the capability to integrate *stovepipe resources* and increase the collaborative interactions of the people using the resources. Thus, the old mindset of having to move resources needed to do a particular job local to one location is no longer necessary or valid.

In the future, clusters of geographically separated resources will be integrated by advanced communications networks into a virtual system. Users will search repositories for the resources needed to solve their particular application, will assemble and configure the resources into a virtual system, and will execute or use the virtual system to solve their problem or accomplish their task. Additionally, products resulting from one task will seamlessly interact with the products of other tasks to accomplish unique functions.

The Collaborative Research and Engineering Environment will emphasize *product and process* models. Product and process model applications capture and provide information about a product technology development process.

Product Models. These models provide details about the specifications and requirements of a product, its structure and behavioral characteristics, its design and development constraint rules, and the different versions of the design and implementation. In this context, a product can be a prototype piece of hardware, a report, or an

"Collaborative Engineering simulations, with integral product and process models, will permit detailed knowledge to be obtained earlier in the conceptual and preliminary design phases where it can have the most influence on life-cycle cost."

experiment/session. Product models also define any special test equipment or facilities required to support design and/or development. For CVP, the product models will have a virtual prototype as the central focus of all other information gathered and collected.

Process Models. While product models focus on all aspects of the product design and development, process models provide detailed definitions of the engineering, development, and evaluation processes used to design and develop the product. Specifically, process models provide information and knowledge on how to use various tools and resources to perform the numerous scientific, engineering, development, and evaluation tasks

associated with technology and product development.

Making Collaboration Work for Each Team Member
Each IPT is made of many participants with different backgrounds, experiences, and specialties. They literally do not speak the same language. The Collaborative Research and Engineering Environment must provide a domain-specific view in the native terminology of each of your team participants. There will be multiple user interfaces as shown in Figure 3. For example, the engineers on the IPT must be able to employ the applications that they customarily use. The engineering user interface must be intuitive for the engineering domain. Similarly, the manufacturing, financial, logistics, management, and end user must be able to access the information, databases, and virtual prototypes in a fashion natural to their way of doing business.

The overall architecture for the CEE is a layered, open-systems approach. The infrastructure consists of that hardware and software which provides functionality to the user, but resides in the background and does not directly interact with the user. The user sees a consistent interface that is based on Web technologies that provide portability to many different platforms, including the workhorse PC on your desktop.

CEE/CVP— Crucial Ingredients
Advances in software and computer technology are making desktop CVP possible and affordable for the engineering process in government and industry research. CVP will become a crucial means of sharing technology and systems integration for research and development and is a natural extension of the Air Force vision for an integrated, common M&S environment, accessed by analysts, researchers, warfighters, developers, and testers. Virtual prototyping and a CEE are crucial ingredients for Acquisition Reform — providing insight for the program manager.

The Theater Missile Defense System Exerciser

TMDSE — Build a Little, Test a Little

LT. COL. STEVE MCQUEEN, U.S. AIR FORCE
RAYMOND B. WASHBURN, P.E. • JOHN F. MORASH

heater ballistic missiles and cruise missiles are a major threat to U.S. forces deployed almost anywhere in the world. To counter this threat, an extremely sophisticated family of theater missile defense (TMD) weapon systems has been developed. To achieve the maximum firepower effectiveness, however, today's TMD Family of Systems (FoS) must be highly interoperable to counter a broad spectrum of threats, environments, and deployment scenarios.

The Theater Missile Defense System Exerciser, or TMDSE, offers the only hardware-in-the-loop (HWIL) test capability available to integrate the entire TMD FoS and test interoperability issues that exist between the separately developed TMD systems.

The TMDSE is a computer-based test tool used to verify interoperability between geographically distributed TMD systems and sensors. This tool "drives" tactical TMD weapon systems with a time-synchronized simulated environment, including threats (theater ballistic missiles, cruise missiles, and aircraft), weather, and terrain.

In June of 1994, the U.S. Army Program Executive Office for Air and Mis-sile Defense (PEO AMD) located in Huntsville, Ala., successfully conducted a Proof-of-Principle (POP) demonstration of a test tool concept that would later become the TMDSE. This POP demonstration, that validated the concept, illustrated the interconnection of two remote TMD tactical hardware sites (the U.S. Army PATRIOT Flight Mission Simulator [FMS] in Bedford, Mass.; and the U.S. Army Joint Tactical Ground Station [JTAGS] located in Azusa, Calif.), simultaneously driven in real time with a common theater test environment.

Following the TMDSE POP, the Ballistic Missile Defense Organization (BMDO) then directed that PEO AMD in Huntsville, Ala., develop the TMDSE, thereby providing the capability to verify that the TMD FoS are integrated and can effectively interoperate across the spectrum of threats, environments, deployments, and contingencies that are delineated in their respective operational requirements documents.

Under the direction of the Deputy for Acquisition/Theater Missile Defense, BMDO, TMDSE development is in its third year and proceeding to an enhanced Build 2 capability. Air Force Lt. Col. Steve McQueen, BMDO/AQI, Systems Integration/BMC3, is the Program Integrator. As executing agent for BMDO, PEO AMD is responsible for the development of the TMDSE Control Segment, development of the Army "drivers," and integration of all Joint elements.

The TMD systems that are integrated into TMDSE will be combinations of existing inventory, product upgrades, and new systems that evolve to enhance mission effectiveness. Its phased, incremental development approach also allows TMDSE to be systematically upgraded to higher levels of fidelity and complexity to support the evolving TMD architecture and its resulting test needs.

As the complexity of the deployable TMD Systems and their operating environments increases, so must the capability of the TMDSE. The implementation of BMDO's direction will be accomplished through the phased development of the TMDSE. Each phase during this development progression is referred to as a Build.

TMDSE Build 1 Configuration
TMDSE's developers, Nichols Research Corporation and Teledyne Brown Engineering, of Huntsville, Ala., completed the TMDSE Build 1 config-

McQueen is the Program Integrator for the Theater Missile Defense System Exerciser (TMDSE) Program. He currently works for the Ballistic Missile Defense Organization, Acquisition System Integration /BMC3 Division (BMDO/AQI), in Washington, D.C. McQueen is a graduate of PMC 94-1, DSMC.

Washburn is a professional engineer with the Program Executive Office for Air and Missile Defense in Huntsville, Ala., and a member of the Army Acquisition Corps (AAC). He is also the executing agent and program manager for the Army portion of the TMDSE Program. Washburn has almost 10 years of prior simulation experience, including work as program manager on the following simulations: Extended Air Defense Simulation, Israeli Testbed, and the United Kingdom Testbed.

Morash is a software engineer with the Program Executive Office for Air and Missile Defense in Huntsville, Ala., and a member of the Corps Eligible program of the AAC. He is also the Assistant Program Manager of the Army portion of the TMDSE Program. Morash has six years of prior simulation experience, including three years on the Extended Air Defense Testbed.

uration in April 1996. Upon completion, the TMDSE Build 1 had 200,000 lines of Ada code. The TMDSE Builds, leveraging heavily from the various Major Defense Acquisition Programs and other defense systems that make up the TMD FoS, make TMDSE a very cost-effective HWIL test capability. As configured, TMDSE interfaces directly with each weapon system via its existing tactical driver, and does not require co-location of test articles. Five sites jointly participated in the TMDSE Build 1 configuration:

- U.S. Army PATRIOT Engagement Control Station (ECS) and Information Control Center (ICC) at the U.S. Army's Missile Command (MICOM) Software Engineering Directorate, Huntsville, Ala.
- U.S. Navy AEGIS Weapon System at the Naval Surface Warfare Center (NSWC) AEGIS Computer Center (ACC) at Dahlgren, Va.
- U.S. Army Joint Tactical Ground Station (JTAGS),PEO AMD, Huntsville, Ala. (The actual JTAGS shelter driver was and is housed at Aerojet Corporation in Azusa, Calif.)

The TMDSE is a computer-based test tool used to verify interoperability between geographically distributed TMD systems and sensors. TMD systems and sensors. This tool "drives" tactical TMD weapon systems with a time-synchronized simulated environment, including threats (theater ballistic missiles, cruise missiles, and aircraft), weather, and terrain.

- U.S. Air Force SHIELD at the Joint National Test Facility (JNTF), Falcon Air Force Base, Colorado Springs, Colo.
- U.S. Air Force Control and Reporting Center (CRC) at the Theater Air Command and Control Simulation Facility (TACCSF), Kirtland Air Force Base, Albuquerque, N.M.

One of the things that separates the TMDSE from other simulations and contributes to its uniqueness is its use of real tactical hardware and real tactical communications. During actual TMDSE execution, the TMDSE makes use of a real PATRIOT ICC and real PATRIOT TMDSE Control Segment shelters, real AEGIS weapon system computers and software, real JTAGS computers and software, and real satellite broadcasts. (The simulated threat "injected" into the JTAGS and SHIELD systems will generate real Tactical Information Broadcast Service [TIBS] and TRAP Data Distribution System [TDDS] cueing messages that will be received by the PATRIOT, AEGIS Weapon System, and CRC elements.)
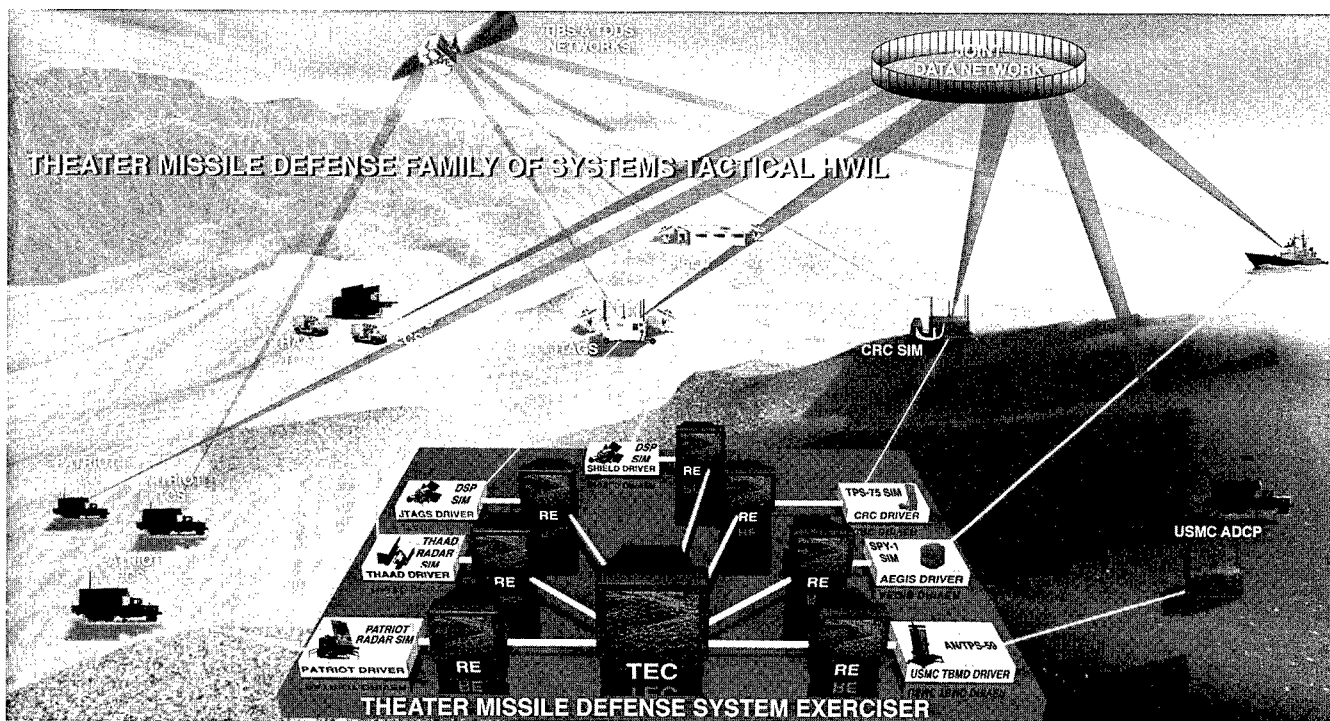
THE THEATER MISSILE DEFENSE SYSTEM EXERCISER OR TMDSE OFFERS THE ONLY TACTICAL HARDWARE-IN-THE-LOOP (HWIL) TEST CAPABILITY AVAILABLE TO INTEGRATE THE ENTIRE THEATER MISSILE DEFENSE FAMILY OF SYSTEMS (TMD FoS) AND TEST INTEROPERABILITY ISSUES THAT EXIST BETWEEN THE SEPARATELY DEVELOPED TMD SYSTEMS.

The TMDSE system is connected to its remote sites using two separate networks: one that addresses the test control functionality of the system, and the other that provides the tactical communications network for the systems under test. These communication networks consist of a combination of local and wide area networks, high bandwidth (i.e., T1 1.544 megabit per second) telephone lines, KG-194 encryption devices, and secure telephones (STU-IIIs), which connect the TBE Test Exercise Controller (TEC) hub to the geographically distributed TMD Tactical Drivers.

The first of these is the TMDSE test control network, which is comprised of high band width (T1) encrypted telephone lines that join the TEC with all Remote Environments at each Tactical Driver site. This network provides a common, synchronized environment to the various tactical systems via a common standardized set of Distributed Interactive Simulation (DIS) protocol data units (PDU). Using DIS PDUs, TMDSE injects a real-time, common threat scenario into real, geographically distributed tactical sensors and weapon systems. The tactical systems respond in real time via their respective tactical communication data nets, including TIBS/TDDS and the Joint Data Net, allowing each individual TMD system to operate synergistically in a tactically realistic battlefield.

This test control network allows the TMDSE to —

- generate realistic scenarios, including natural (weather and terrain) and artificial environments, including tactical missiles and air-breathing threats;
- generate realistic missile interceptor flyouts;
- generate realistic interceptor and threat debris in real time;
- coordinate and synchronize the stimulation of the track processing systems; and
- coordinate and synchronize dynamic events that are a result of offen-

sive/defensive actions. ("Dynamic" events, as opposed to "scripted" events such as tactical missile flyouts, are the defensive actions taken by the tested weapon systems in response to the scripted threats. For example, the reaction(s) of a PATRIOT fire unit to approaching tactical missiles or aircraft must be represented dynamically in real time.)

The second network used, the tactical communications network, connects the tactical systems to each other. These interfaces must appear to be the natural communications expected of the TMD components with regard to protocol, message formatting, and routing selection. Actual Joint Tactical Information Distribution System (JTIDS) radio terminals cost approximately $1 million each and operate via line-of-sight, which means that they are restricted to distances of 30-50 kilometers. Due to the high cost of these radios and the fact that geographically distributed TMDSE systems are sometimes separated by distances of hundreds or thousands of miles, another means had to be found to emulate tactical communications.

For TMDSE, the U.S. Naval Command, Control, and Ocean Surveillance Center's Link 16 Emulator and Communications Monitor (the "NRaD Gateway") provided the tactical communication link connectivity between the individual weapon system platforms using the Tactical Digital Information Link (TADIL) J protocols and message formats emulating a JTIDS. Future planned enhancements to the NRaD Gateway will increase the fidelity of the TMDSE and allow land-line emulation of satellite transmissions.

In the first quarter of fiscal year 1997, the TMDSE Build 1 configuration was installed at the Joint National Test Facility (JNTF) located at Falcon Air Force Base in Colorado Springs, Colo. BMDO designated the JNTF to be the operational facility where FoS tests will be run. PEO AMD, however, will continue as the developer for the follow-on configurations.

TMDSE Build 2 Configuration

The TMDSE Build 2 is scheduled to be completed by July 1997. By the end of third quarter, fiscal year 1997, the TMDSE Build 2 requirements and functional capabilities will demonstrate an evolving capability for TMD system integration and interoperability testing. In addition to the original five TMDSE Build 1 systems (PATRIOT, AEGIS, CRC, JTAGS, and SHIELD), the following two additional TMD Tactical Systems will participate in the Build 2 configuration:

- U.S. Army Theater High Altitude Area Defense (THAAD) weapon system, PEO AMD, Huntsville, Ala.
- U.S. Marine Corps HAWK TPS-59 radar system, USMC Systems Command, Syracuse, N.Y.

TMDSE Verification, Validation, and Accreditation (VV&A)

The technical difficulties and costs associated with ensuring adequate verification and validation (V&V) of modeling and simulation (M&S) are major challenges in successfully executing a simulation development enterprise within the DoD. In today's current regulatory environment, DoD and Service policies and directives generally mandate that M&S be subjected to a formal, structured verification, validation, and accreditation (VV&A) program. Within the Services, and BMDO in particular, guidance and oversight for M&S VV&A is becoming quite explicit. Timely and successful accreditation of simulations with embedded legacy models and codes, such as TMDSE, require explicit, focused V&V evaluations that are tied to the simulations' intended use.

The best means for accomplishment of this complex task is a rigorous, focused V&V and evaluation effort, which is adaptable to the particular unit-under-test. Currently, for TMDSE a tailored V&V program is being pursued that is based on —

- leveraging ongoing, system-level simulation development, test, and V&V activities;
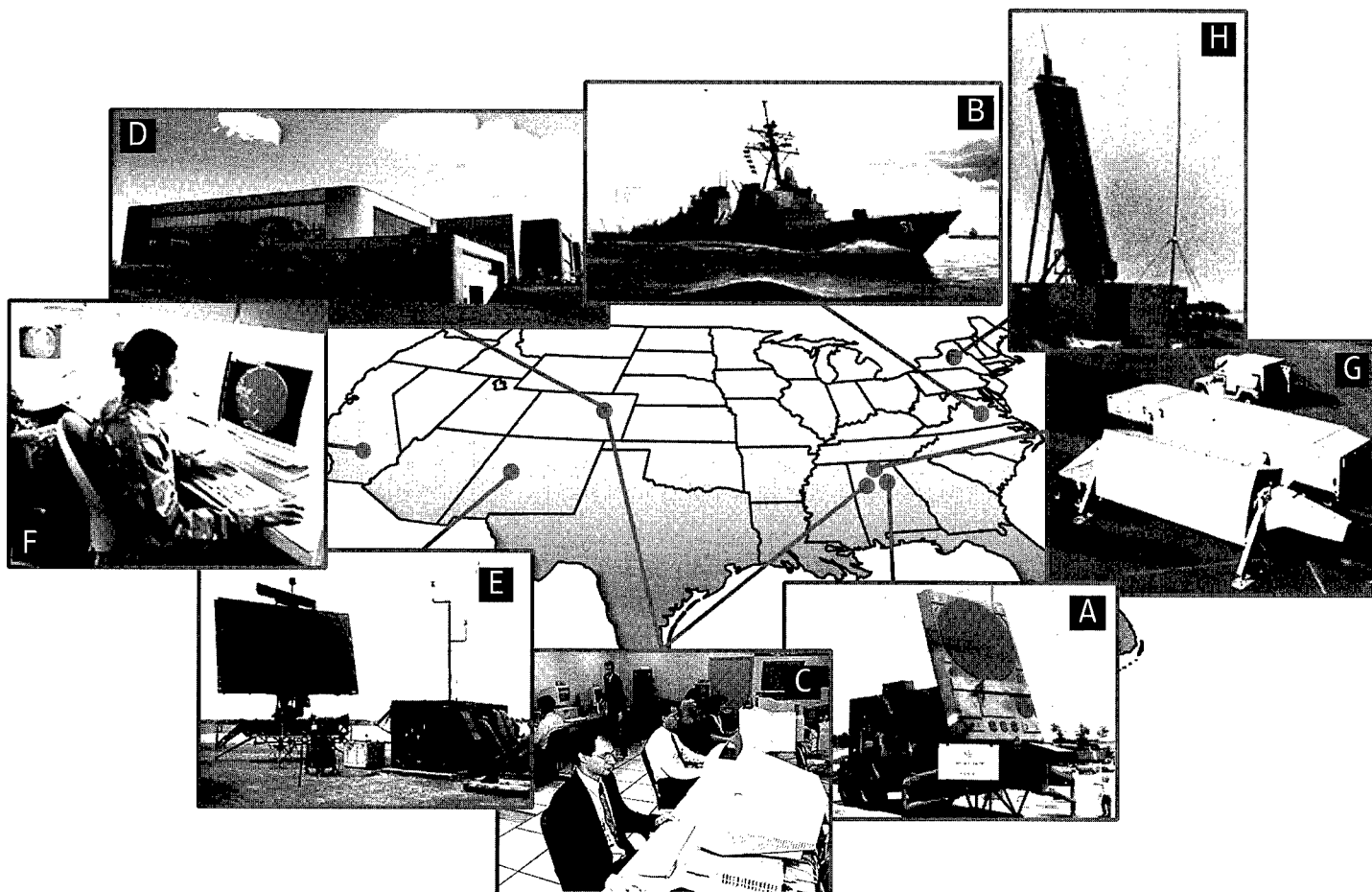
The TMDSE Build 1 configuration consisted of joint participation by the following five sites: (A) U.S. Army PATRIOT Engagement Control Station (ECS) and Information Control Center (ICC) at the U.S. Army's Missile Command (MICOM) Software Engineering Directorate (SED), Huntsville, Ala.; (B) U.S. Navy AEGIS Weapon System at the Naval Surface Warfare Center (NSWC) AEGIS Computer Center (ACC) at Dahlgren, Va.; (C) U.S. Army Joint Tactical Ground Station (JTAGS), PEO AMD, Huntsville, Ala. [(F) the actual JTAGS shelter driver was and is housed at Aerojet Corporation in Azusa, California]; (D) U.S. Air Force SHIELD at the Joint National Test Facility (JNTF), Falcon Air Force Base, Colorado Springs, Colo.; and (E) U.S. Air Force Control and Reporting Center (CRC) at the Theater Air Command and Control Simulation Facility (TACCSF), Kirtland Air Force Base, Albuquerque, N.M. In addition to the original five, TMDSE Build 1 systems (PATRIOT, AEGIS, CRC, JTAGS, and SHIELD), two additional TMD Tactical Systems will participate in the Build 2 configuration: (G) U.S. Army Theater High Altitude Area Defense (THAAD) weapon system, PEO AMD, Huntsville, Ala.; and (H) U.S. Marine Corps HAWK TPS-59 radar system, USMC Systems Command, Syracuse, N.Y.

- verifying TMDSE through a series of well-defined and coordinated functional configuration audit activities;
- validating TMDSE at the system level by explicitly linking TMDSE validation activities to existing, ongoing, or planned system test activities as the principal source of "real world" data; and
- generating the essential information necessary for V&V reports and findings, which provide the evidence required to support the accredita-

tion decision by potential TMDSE users and operational testers.

The set of specific validation activities selected for execution are being closely coordinated with the individual system developers and will be based upon TMDSE accreditation data needs, the realities of the system programs, and the fixed resources available for TMDSE V&V within the respective Services and BMDO. The validation activities for TMDSE are being defined by the sponsor for exe-

cution by the respective system simulation activity.

Hardware-in-the-Loop Test (HWILT)

The fiscal year 1996 BMDO Hardware-in-the-Loop Test (HWILT-96) was conducted in September 1996 using the TMDSE Build 1 software. Navy Cmdr. Don Gold of BMDO was the program integrator for the HWILT-96. The test was executed and controlled under the direction of Army Lt. Col. Chuck Treece of PEO AMD, from the develop-

mental TMDSE Test Exercise Controller located at Teledyne Brown Engineering in Huntsville, Ala.

The HWILT-96 tactical weapon system participants generated and distributed tactical communication messages, including Joint Data Network, TADIL-J, and live TIBS and TDDS broadcasts. Dedicated TIBS and TDDS exercise channels were used by TMDSE during the test to preclude the broadcast of exercise tactical event messages into the actual scenario theater's operational network. Ongoing analysis of the collected data is currently being conducted.

For the HWILT-96, a northeast Asia scenario, including a dynamic environment of threats (theater ballistic missiles, aircraft, and cruise missiles), interceptors, weather, terrain, and threat/interceptor fragment debris was injected into the HWIL tactical weapon systems. The HWILT-96 test event employed real tactical TMD assets and operators, communicating via real-world tactical communication links responding in real time as if in an actual battlefield situation.

Future HWILTs will be executed and controlled from the BMDO JNTF, Falcon Air Force Base, Colorado Springs, Colo. Installation of the TMDSE Build 1 capability has been completed at the facility. Upon completion and demonstration, subsequent TMDSE builds will be installed at the JNTF for the operational execution of future TMD FoS tests.

The successful execution of the HWILT-96 enabled the establishment of policies and procedures for direction and conduct of future FoS tests, the development of lessons learned from the early use of TMDSE for FoS testing to support definition of future TMDSE enhancements, and early insight into FoS interoperability with respect to selected TMD Command and Control (C^2) Plan objectives. This experience, in conjunction with the full cooperation between BMDO, the operational test agencies, and the Ser-

vices will make TMDSE the tool of choice whenever TMD system test and evaluation issues are addressed.

Leveraged Activities

The PEO-AMD provided critical support to Joint Project Optic Cobra (JPOC) '96 and Joint Exercise Roving Sands '96, conducted in June 1996. JPOC is an annual U.S. Central Command TMD exercise supported with BMDO funding. Conducted in the Fort Bliss, Texas, and White Sands Missile Range, N.M., areas as a part of the U.S. Forces Command-managed Joint Exercise Roving Sands, JPOC is the world's largest Joint Tactical Air Operations exercise. During the exercise, PEO AMD successfully implemented and executed the Cooperative Air and Missile Defense Network (CAMDEN), a distributed interactive simulation infrastructure capability that provides an integrated tactical missile and aircraft training environment for the U.S. and allied soldiers, sailors, airmen, and Marines participating in the Roving Sands exercise. Some CAMDEN components were derived from ongoing PEO AMD simulation and test and evaluation programs funded by BMDO, the Defense Modeling and Simulation Office, and from other Service and Joint programs. Particularly noteworthy, however, are the TMDSE-developed elements that include the PATRIOT Digital Flight Mission Simulator, the JTAGS simulator, the THAAD Test Controller, and the AEGIS weapon system at NSWC.

Summary

With declining resources, missile flight test costs are a major expense to program offices. Many constraints influence live flight tests such as range restrictions, treaty limitations, environmental concerns, and range safety issues. Program offices are no longer able to conduct the number of flight tests that they once did. A single flight test can cost from $25 to $50 million when target, interceptor, range, and personnel costs are figured in. In addition, the number of simultaneous engagements per test is limited to probably no more than two. However,

weapon system interoperability assessment is required in a "target enriched" environment. For these reasons, HWIL testing is becoming increasingly important due to the significant cost savings that can be achieved by its use, and the TMDSE is being viewed as BMDO's key FoS test tool resource.

TMDSE is more economical than live flight tests and allows TMD systems to explore interoperability issues into areas not possible during live flight tests, such as multiple, simultaneous engagements and stressing environments. Expanding beyond range limitations as well as logistical considerations, TMDSE provides an economic solution to live flight tests.

The TMDSE is an integral part of BMDO's overall test and evaluation strategy that supports the successful acquisition of the TMD FoS. The strengths of the TMDSE include its design flexibility that facilitates the incorporation of new tactical weapon system elements by easily interfacing these elements into the distributed, real-time TMDSE network. As the TMD FoS evolves, the TMDSE will mature to meet the challenge of assessing the interoperability of these deployed weapon systems.

The "build-a-little, test-a-little" methodology implemented for the TMDSE will reduce development risks, pace the program to the funding appropriations, and tailor the "builds" to the TMD weapon system development schedules. The experience of the PEO AMD TMDSE development team has provided a solid foundation to leverage into the Build 3 development effort. This experience, in conjunction with the full cooperation between BMDO and the Services, will make TMDSE the tool of choice whenever TMD system test and evaluation issues are addressed.

For additional information on the TMDSE Program, visit **http:// peoamd.redstone.army.mil/tmdse/** – our TMDSE Home Page on the World Wide Web.

A New Vision, Further Leveraging Emerge From Orlando's Simulation Superstructure

WTET Prototype Developed By Collaboration, Partnerships, Cooperation Between Government and Industry

JEFFREY D. HOREY

"Defense capabilities in education and training represent an important resource. New programs will accelerate transfer of this experience to civilian institutions. The Department of Defense and NASA [National Aeronautics and Space Administration] have invested heavily, both in the hardware and software needed for advanced instructional systems; they have accumulated valuable experience in how to use the new technologies in practical teaching situations. The Navy Training Systems Center [now the Naval Air Warfare Center Training Systems Division] and the Army Simulation, Training, and Instrumentation Command together spend about $1 billion a year on training systems. There are over 150 defense simulation and training companies serving these needs in Central Florida alone...."[1]

—President William J. Clinton
Vice President Albert Gore, Jr.
February 22, 1993

From the nationally recognized simulation superstructure in Orlando comes a new vision — and further leveraging.

The acquisition manager of today must be aware of alternative vehicles, available outside of the Federal Acqui-

sition Regulations, which can be used to ensure a technologically superior product, produced in a cost-effective manner by a reliable industrial source.

Weapons Team Engagement Trainer

An example of one such vehicle is the cooperative agreement among the Naval Air Warfare Center Training Systems Division (NAWCTSD); SBS Technologies, Inc.; and Camber Corporation, to produce the Weapons Team Engagement Trainer (WTET). The

Office of the Secretary of Defense, under the Defense Laboratory Partnership Program for Technology Transfer, funds the agreement.

The WTET is an advanced Special Weapons and Tactics (SWAT) training system that allows multiple member weapon teams to participate in multiple room (and multiple screen) threat engagements, under shootback and advanced individual and team performance feedback conditions. NAWCTSD initially developed the system.

FLORIDA CENTER OF EXCELLENCE FOR SIMULATION
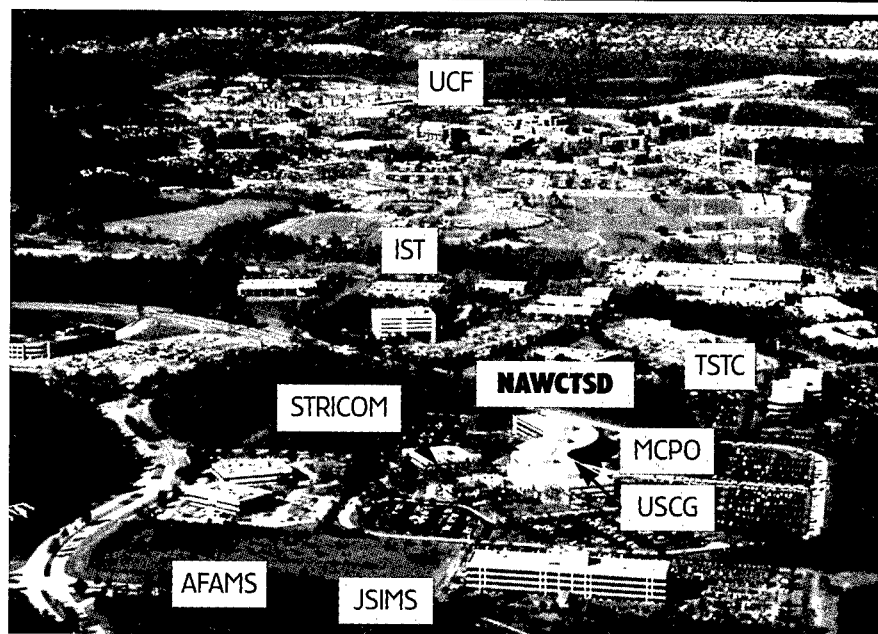
Horey is currently a Project Director, Naval Air Warfare Center Training Systems Division (NAWCTSD), Orlando, Fla. He holds an M.S. in Industrial Psychology from The George Washington University. For the past 10 years, he has worked in the areas of training assessment, design, and evaluation for NAWCTSD.

A prototype of the WTET was extensively and successfully demonstrated to law enforcement agencies and special operations groups of the U.S. military. The enhanced production version will be demonstrated in 1997. It will provide instructor-controlled training and feedback for a wide range of law enforcement and military threat situations. Included in the system will be the training capability for use of force decision making; marksmanship skills and analysis; SWAT operations, including sniper training; and use of less-than-lethal-force weapons.

Industry and the Commercialization Process

The industry partner, SBS Technologies, Inc., already produces a judgmental use-of-force trainer, for both the law enforcement and military communities. Under the commercialization of WTET, the merging of their current trainer and the many unique features of WTET will result in a training system that will provide a full and complete range of weapons, team, and engagement training under realistic tactical situations.

This is the first use of a cooperative agreement for commercialization within the Naval Air Systems Command, NAWCTSD's parent organization. As such, WTET has been designated as a pilot project.

Authority to use the legal vehicle selected for this commercialization process — the cooperative agreement — was recently granted to the military services.

The commercialization process consists of a two-year cycle of system development by NAWCTSD and its industry partners, along with the direct involvement of the user community. Traditional programmatic reviews are ensured during the life of this nontraditional technology transfer project. The program management, engineering oversight, and training requirement functions during the commercialization are being performed by NAWCTSD.

User Community

Interested user agencies also will be integrated into the effort to ensure the final product reflects the requirements of the military and civilian law enforcement communities (federal, state, and local). As part of the program plan, two systems will be available for evaluation by those communities.

Sponsored in part by the National Institute of Justice, the initial system installation has been designated for the Los Angeles County Sheriff's Department Laser Village Training Facility. Ideally, it should be operational by the end of 1997, and will be available for use by military and law enforcement agencies in and around Los Angeles.

Commenting on the system, Lt. Mike Grossman, manager of the Force Training/Laser Village Training Facility in Los Angeles, says, "It doesn't get any better. It's really a great opportunity to be able to participate in a program where so many different agencies are working to make this happen, and be able to provide state-of-the-art training for Southern California — for military, federal, state, and local law enforcement. I think the sharing of knowledge and expertise, and the joint venture doesn't get any better. We appreciate the opportunity to be the host for this kind of operation."

A second system will be available for demonstration at relevant trade shows and for possible temporary installations at select user agencies.

Product Concept Evolves

Cost reduction is not the only advantage of this dual-use effort. Since the cooperative agreement between the Navy and its industry partner was signed in February, 1996, the concept of the product has evolved.

The concept for the commercially produced system now incorporates marksmanship, use-of-force decision making, special weapons and tactics, and advanced military weapon team

training into a user-friendly, easily upgraded modular system design.[2]

Other Opportunities

Other opportunities exist for collaboration between the Department of Defense and the entertainment industry. Mechanisms are available that encourage the government's collaboration with industry to conduct joint research and development (R&D). Under this framework, the government gains the right to use the research results for government purposes; the company holds all commercial rights. Both partners share the costs of conducting the research.

Products such as games and location-based entertainment, as well as the underlying technology used to create entertainment products are targets of opportunity.

Why would the Navy consider partners with such widely diverse motivations and objectives? Both actively draw from modeling and simulation technologies, to produce products.

The Navy uses commercial games in training programs, on a limited basis. The games are used as a "backdrop" to stimulate behavior — such as coordination and communication between pilots and crew.

Consider the sailor or student of today. Many have hands-on experience — and expertise — with PC-based learning. The Navy has found that computer-based games provide an effective, low-cost way to simulate flying and other task experiences. The applications must be appropriate — those that do not require expensive hardware/ software to create highly accurate, real-time situations.

The joint R&D does not have to result in a product. It can be directed at the underlying technology. The agreements that promote this collaboration are not covered by the Federal Acquisition Regulations, which apply to government contracts. They can also be exempted from the Freedom of Infor-

mation Act. To attract these commercial partners, the government recognizes that intellectual property must be protected.

Market Dynamics

These types of agreements help move the technology out of the laboratory and into the marketplace. The technology becomes available to civilian users, allowing the military to buy resultant commercial off-the-shelf products.

Invaluable benefits from these market dynamics emerge, as a broader customer base lowers the per-unit cost. The military is getting the commercial price to acquire a system, not "cost-plus." Civilian users gain the benefits of more advanced technology (typically, in the area of learning technology, where the Department of Defense has the lead). We will see more of this technology moving into workforce development and K-12 education.

The rapid pace of change to Department of Defense acquisition policy means that an activity's internal acquisition policy and procedure directives require continuous updating. As a result, NAWCTSD developed the *NAWCTSD Acquisition Guide*, an electronic acquisition guide, considered to be a faster method of communicating new policy to NAWCTSD's own acquisition managers.[3] First introduced in March via the NAWCTSD Website, the guide includes an Acquisition Roadmap, which is a tailored representation of the Department of Defense acquisition process, as revised.

ENDNOTES

1. Clinton, President William J., and Vice President Albert Gore, Jr., "Technology for America's Economic Growth, A New Direction to Building Economic Strength" (The White House, Feb. 22, 1993, p. 14).
2. For more on WTET, visit http://www.ntsc.navy.mil/wtet/wtet.htm at NAWCTSD's Website.
3. To view or access the *NAWCTSD Acquisition Guide*, visit http://www.ntsc.navy.mil/acqguide/acqguide.htm at NAWCTSD's Website.

COST ANALYSIS STRATEGY ASSESSMENT MODEL (CASA) COMES OF AGE

Lt. Col. Carl Gardner, U.S. Army

The CASA model, profiled in the January-February 1996 edition of *Program Manager* magazine,[1] recently underwent a major overhaul. CASA is actually a set of analysis tools formulated into one functioning unit. It collects, manipulates, and presents as much of the cost of ownership as the user desires. As depicted in the table, CASA's configuration includes a number of programs and models that allow you to generate data files, perform Life Cycle Costing (LCC), sensitivity analysis, LCC risk analysis, LCC comparisons, and summations.[2]

Version 4.0 brings the ease of Windows™ to its users and allows export of data in spreadsheet format. The new logical input sequence (in work breakdown structure format) allows easy data entry. The flexibility to perform "What if" drills is increased by the addition of the capability to vary the levels of maintenance (1-10) and a readiness target. An online tutorial provides initial training and assistance during use. CASA can be downloaded from the following website, via the Defense Systems Management College's Home Page:

http://dsmc.dsm.mil/specfeat/htm

According to Keith McLendon, U.S. Army Logistics Support Activity, CASA Version 4.0 information may also be downloaded from the following website, via the U.S. Army Logistics Support Activity's Home Page:

http://www.logpars.army.mil/CASA.htm

REFERENCES

1. Manary Joel M., "DSMC's CASA Model Still Going Strong," *Program Manager* Magazine, January-February 1996.
2. *CASA Users Manual*, Defense Systems Management College, February 1994.

Editor's Note: Gardner is a Professor of Logistics Management, Logistics Management Department, Faculty Division, DSMC. He is a graduate of APMC 95-1.

CASA CAPABILITIES

Life Cycle Cost Estimating	Trade-Off Analyses	Repair-Level Analyses	Production Rate and Quantity Analyses
Warranty Analyses	Spares Provisioning	Resource Projections (e.g., Manpower, Support Equipment)	Risk and Uncertainty Analyses
Cost Driver Sensitivity Analysis	Reliability Growth Analyses	Operational Availability	Analyses with Automated Sensitivity Analysis
Spares Optimization To Achieve Readiness Requirements	Operation and Support Costs	Contribution by Individual Components of The System	

National Simulation Superstructure

Disney Doesn't Have a Monopoly on the World of "Make Believe"

KATHLEEN M. CLAYTON

The imagination, creativity, and technically sophisticated world of "make believe" for which this city is famous does not begin and end with the creations of Walt Disney. The Department of Defense (DoD) is the fortunate beneficiary of a concentration of modeling and simulation (M&S) expertise – a national simulation superstructure, also located in Orlando. This collection of collocated defense agencies, proven M&S companies, academic institutions with M&S curriculum, and state and local governments is committed to the enhancement and use of this leveraging tool as a vital national resource.

Recognizing the advantages in leveraging this array of talent to provide the best possible products to the Army, the U.S. Army Simulation, Training, and

> The *Team Orlando* Charter outlines the synergy of the group as they recommit themselves to "work together to share information and leverage programs and technology in the best interest of the Department of Defense and the American taxpayer."
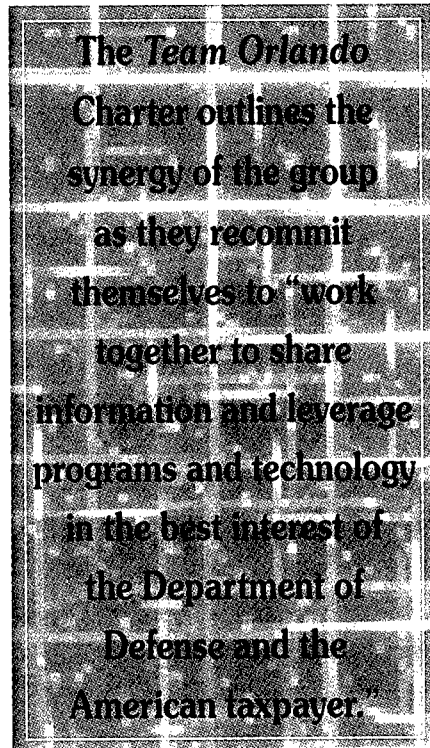
Instrumentation Command (STRICOM) recently led the formalization of the concepts inherent in the success of this unique M&S community. Naming this simulation superstructure *Team Orlando*, STRICOM and six other key players (the Naval Air Warfare Center Training Systems Division [NAWCTSD], the Joint Simulation Systems Office [JSIMS], the Marine Corps Program Office, the Air Force Agency for Modeling and Simulation [AFAMS], the Institute for Simulation and Training [IST], and the Training and Simulation Technology Consortium [TSTC]) immediately signed on as Charter Members. The *Team Orlando* Charter outlines the synergy of the group as they recommit themselves to "work together to share information and leverage programs and technology in the best interest of the Department of Defense and the American taxpayer."

Origins

Dating from the 1950s two Services, the U.S. Army and the U.S. Navy, built and enjoyed a special relationship in the M&S community. The informal concepts behind this relationship are the basis of *Team Orlando*. The success of this formula provides a history of mutual benefits for both Services. Today STRICOM and the Naval Air Warfare Center Training Systems Division (NAWCTSD) benefit greatly from a matured inter-Service relationship affording each entity the full benefits of leveraged resources, manpower, and

IST/UCF DYNAMIC TERRAIN AREA OF VISUAL SYSTEMS LABORATORY.

Clayton is a Project Director at the U.S. Army Simulation, Training, and Instrumentation Command, Orlando, Florida. She holds a B.A. from Arizona State University and an M.A. from Georgia State University.

technological expertise, creating a strong foundation of success and the springboard for joint projects, such as JSIMS. The Marine Corps Program Office, another tenant of NAWCTSD, works as the principal representative for ground and air M&S programs impacting the U.S. Marine Corps. The U.S. Air Force, also seeing the benefit of leveraging the resources in the area, established the Air Force Agency for Modeling and Simulation (AFAMS) in Central Florida and plans to grow this organization in the next few years.

The State of Florida recognized this growing industry by establishing the Institute for Simulation and Training at The University of Central Florida (IST/UCF) in 1982. The IST provides a common source of academic studies and research in support of the M&S community.

In 1985, the Governor and Cabinet of the State of Florida issued a resolution recognizing the "Center of Excellence for Simulation." Today, Enterprise Florida, as the state's economic development unit, recognizes the significant contribution of STRICOM, NAWCTSD, the Marine Corps Program Office, and the growing AFAMS as the mainstays of the Center of Excellence.

In 1993, as further testament to the capability of this unique M&S community, the TSTC was established under the White House Technology Reinvestment Project. The TSTC was chartered to be a non-profit, one-stop source for all commercial applications of these sophisticated military and space M&S technologies.

Team Orlando in Action — DoD Membership

Over 1700 M&S professionals, representing the four primary uniformed services of the United States, comprise the government contingent of *Team Orlando*. The relationships and integration between and among these
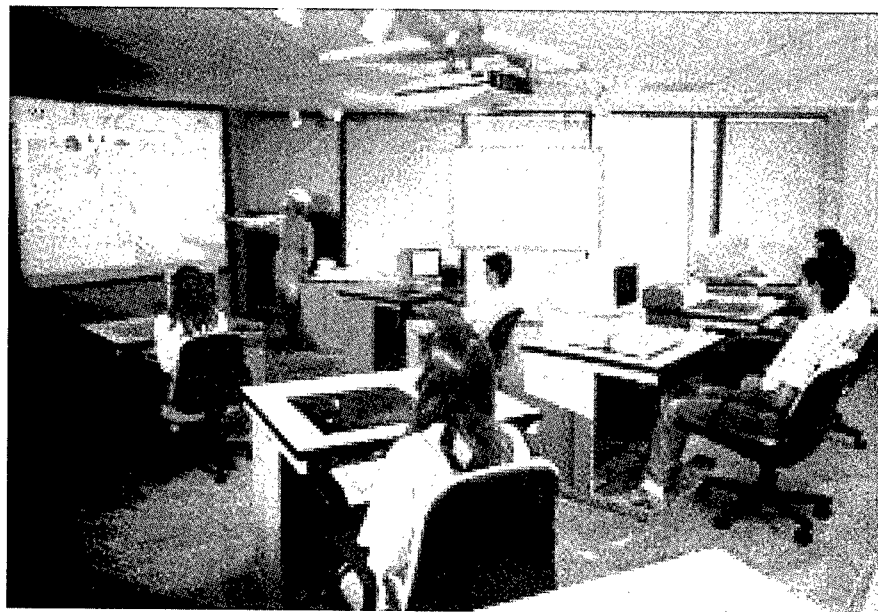
dedicated professionals is where the benefits of leveraging begin. Cooperative efforts between these government professionals, industry, and academia work to realize the benefits for the warfighter and the taxpayer.

One of the best examples of the *Team Orlando* concepts in action is exemplified by the symbiotic relationship between STRICOM, NAWCTSD, and the Marine Corps Program Office. The organizations share facilities, with STRICOM and the Marine Corps Program Office as tenants. STRICOM and the Marine Corps Program Office buy various types of base operations/infrastructure support services, and work years of contracting and engineering talent from NAWCTSD. This arrangement benefits all three organizations by sharing expertise, techniques, and methodologies, further enhancing integration and synergy among the Services.

The growing U.S. Air Force presence in this national simulation superstructure promises an additional potential to develop systems that combine the best of the Services. The mission of AFAMS is to implement DoD, Joint, and Air Force M&S Policy/Standards and provide Service-level M&S support to Joint, Combined, and Air Force Activities. This office also supports Air Force and Joint Wargaming Exercises, and supports other major joint M&S

initiatives, such as the Joint Modeling and Simulation System (JMASS). Clearly, the synergy provided by *Team Orlando* will be vital as AFAMS, STRICOM, and NAWCTSD support and manage the development of joint synthetic battlespace and advanced distributed simulations of their respective Service customers.

Additionally, the JSIMS mission provides Commanders in Chief and the Services with next generation training, mission planning, and mission rehearsal capabilities. The JSIMS Joint Program Office values the benefits of the external joint community and the synergy created under *Team Orlando*.

The DoD members of *Team Orlando* also include representatives from Army Research Institute, Army Research Laboratory, Army National Guard, JSIMS Maritime, U.S. Naval Reserve, U.S. Marine Corps Reserve, Air Force Materiel Command Operating Location, and representatives from our NATO allies in Germany and the United Kingdom. Each of these organizations capitalize on the opportunity to use M&S solutions to their full advantage in fulfilling their individual missions.
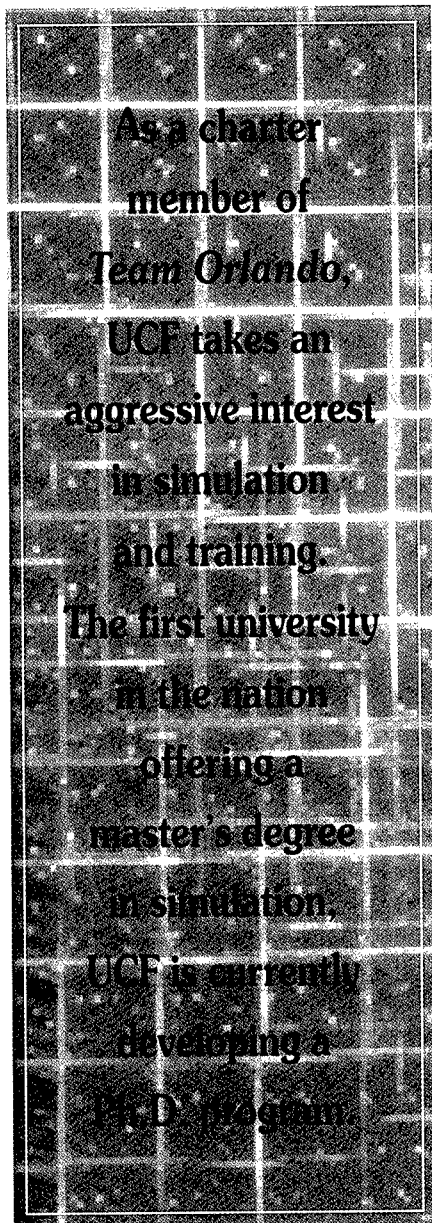
Other Government Agency Membership.

In the spirit of *Team Orlando*, STRICOM and National Aeronautics and

Space Administration (NASA) recently signed an Interagency Agreement for Technology Cooperation. This agreement serves as a foundation for a more lasting technology transfer program and continuous business relationship. By cultivating this business relationship, STRICOM and NASA promote appropriate simulation and related technology for national Service, space, and other applications. Delineated in the agreement is the sharing of information, technologies, methodologies, consultation, and other services; and working toward further collaboration of efforts involving simulations, simulators, and instrumentation technology and methodologies. Also included are joint research or specific projects, whenever possible.

The Florida High-Technology Corridor Council and Enterprise Florida are working together with STRICOM, NAWCTSD, and approximately 150 companies involved in modeling, simulation, and training activities in Central Florida to provide for continued growth and recognition of the importance of this national asset. This national simulation superstructure, guided by the concepts of *Team Orlando*, is growing and attracting new simulation interests every year.

Academic Membership

Located adjacent to STRICOM and NAWCTSD, the University of Central

As a charter member of *Team Orlando*, UCF takes an aggressive interest in simulation and training. The first university in the nation offering a master's degree in simulation, UCF is currently developing a Ph.D. program.

Florida (UCF), Institute for Simulation and Training (IST) works to fulfill its mission as a resource and focal point for simulation and training technologies. The synergism generated through *Team Orlando* enables IST to play a key role in advancing the art of simulation and training technologies and the transfer of those technologies to the civilian sector. These efforts enhance our society and get the most return from research dollars.

As a charter member of *Team Orlando*, UCF takes an aggressive interest in simulation and training. The first university in the nation offering a master's degree in simulation, UCF is currently developing a Ph.D. program. DoD employees are encouraged to take full advantage of these resources.

Industry Players

DoD *Team Orlando* members have significant involvement with many of the 150 commercial industry partners located here in Central Florida. Many serve as a contractor or subcontractor on crucial DoD programs, supporting $1 billion in contracts annually. As we partner with local industry, *Team Orlando* DoD members benefit from the unique opportunity to take advantage not only of federal Acquisition Reform initiatives, but also reap the rewards provided by the synergy created by this simulation superstructure.

Many other industry players are embarking with *Team Orlando* on a journey toward dual-use exploration. For example, STRICOM and the Walt Disney Company, the premier expert on the use of M&S in the entertainment industry, have an ongoing relationship exploring dual use and technology transfer opportunities.

The mission of TSTC is to assist private/commercial industry to acquire simulation and training technologies and capabilities previously available only to the U.S. military and space effort. TSTC membership includes

IST/UCF VIRTUAL ENVIRONMENT TESTBED.

STRICOM, NAWCTSD, AFAMS, NASA, IST, and over 20 private companies. One project under exploration by the TSTC is a regional transportation planning system, for which the technology is applicable to the national defense and its readiness, as well as federal, state, regional, and local transportation planners. TSTC is also exploring other simulation and training projects with the American Red Cross, Universal Studios, Kennedy Space Center, and the Federal Emergency Management Agency (FEMA).

The work of TSTC — to raise awareness and facilitate technology transfer and jobs — clearly make it an asset to *Team Orlando* by sustaining the defense industrial base upon which the Department of Defense must rely for affordable, state-of-the-art M&S technology development and applications.
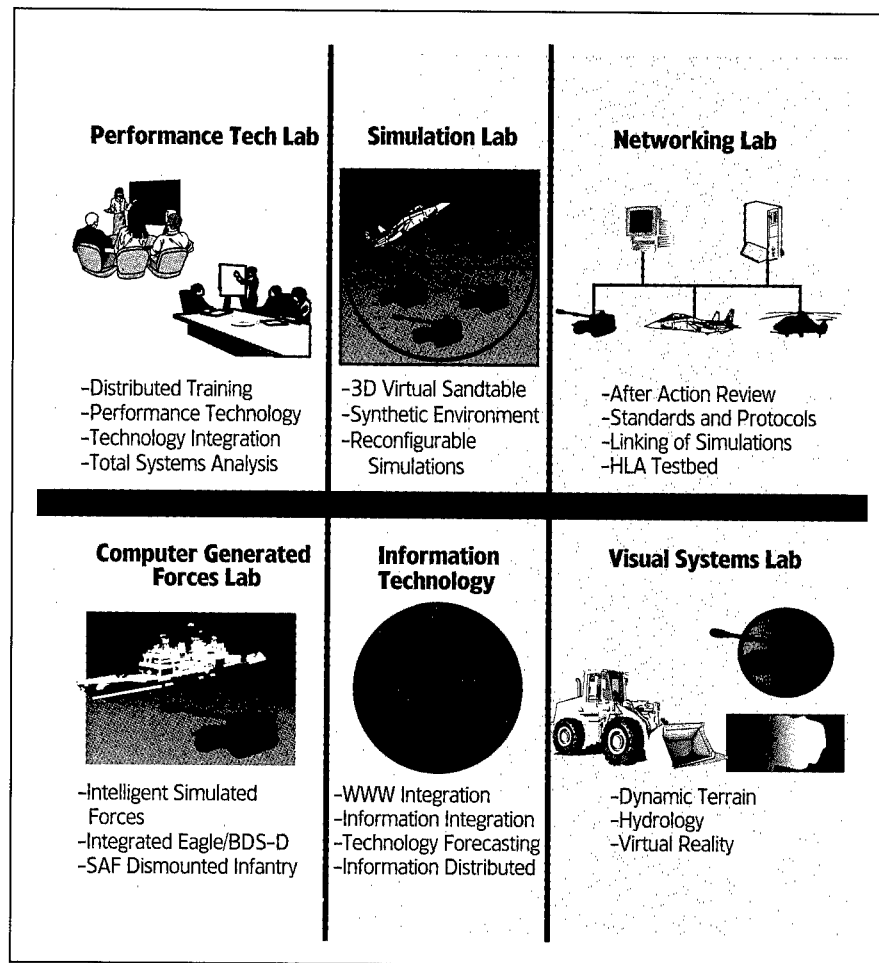
Recognized Results

As a member of this national simulation superstructure — *Team Orlando* — success is multiplied among all the members. This national simulation superstructure provides DoD with an enormous, technologically advanced support unit. Our contractors provide us with better products through retention of highly skilled jobs, advancements in the M&S industry, and academic support for the technical educational needs required by the simulation industry.

The value of this national simulation superstructure, led by *Team Orlando*, can be seen daily in many areas:

- Growing Number of High-Technology Jobs
- Reduced Cost for DoD End Items
- Shorter Time from Technology Development to End User Applications
- Number of Strong Bidders for DoD Contracts
- Number of Cooperative Research and Development Agreements (CRADA)
- Grants And Cooperative Agreements Integrating Collaboration in Research and Development

Performance Tech Lab
-Distributed Training
-Performance Technology
-Technology Integration
-Total Systems Analysis

Simulation Lab
-3D Virtual Sandtable
-Synthetic Environment
-Reconfigurable
  Simulations

Networking Lab
-After Action Review
-Standards and Protocols
-Linking of Simulations
-HLA Testbed

Computer Generated Forces Lab
-Intelligent Simulated
  Forces
-Integrated Eagle/BDS-D
-SAF Dismounted Infantry

Information Technology
-WWW Integration
-Information Integration
-Technology Forecasting
-Information Distributed

Visual Systems Lab
-Dynamic Terrain
-Hydrology
-Virtual Reality

Team Orlando members plan to continue to expand these contacts and agreements, leveraging and enhancing the innovations being developed by and between the growing membership of the team for the overall long-term benefit of all.

This growing force of government, industry, and academia M&S experts share a common vision for the future of M&S and its recognized development. The continued success of *Team Orlando* is vital to the shared goal of cost reduction by leveraging of DoD M&S dollars. By working to preserve and advance the industrial base, increase the willingness of industry to invest their R&D efforts in M&S, foster innovative applications of the latest technology, and lev-

erage the numerous M&S projects in other areas, the Department of Defense, through the efforts of *Team Orlando*, can maintain its technological superiority at a reduced cost into the future.

The *Team Orlando* model is a success story. If fostered, it will assure the nation a network of highly qualified companies ready and able to develop superior M&S technologies and products for the Department of Defense. As written in the STRICOM crest, "All But War Is Simulation." These state-of-the-art, "make believe" M&S solutions will provide the warfighters of tomorrow, operating under the concepts of *Joint Vision 2010*, with capabilities to ensure the success of U.S. Forces into the next millennium.

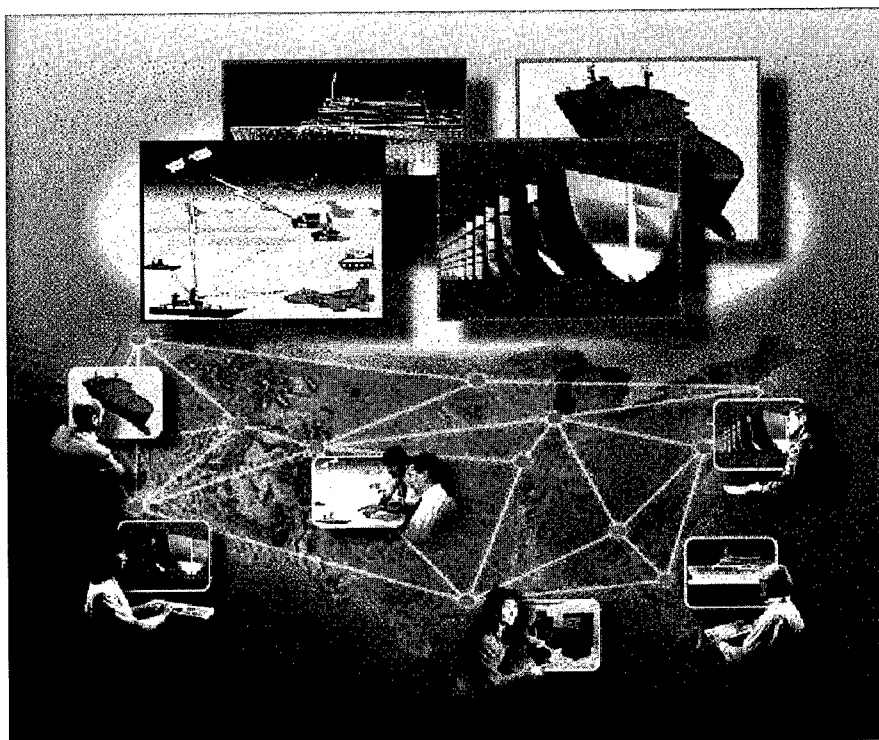# Integrated Ship Defense Modeling and Simulation Pilot Program

If PMs Bring M&S Into Focus DoD-Wide, They'll See a Real Return on Investment

LORRAINE SHEA • MICHAEL POBAT

Can modeling and simulation (M&S) truly be a highway for the program manager to navigate the road to project success over the life cycle? Currently, the acquisition community is embracing Simulation Based Acquisition (SBA) initiatives, but where is the evidence that there is a payoff here? Where is the real value-added?

Traditionally, program managers navigate the life-cycle process in different ways using a variety of available tools, including M&S. So what is new here? What is this M&S revolution all about?

As a system grows throughout the engineering and development phase, SBA — when used by the engineers who are designing the system and the platform it will ride on; analysts performing trade studies and investment analyses; and testers responsible for certifying the design meets specifications — allows a conceptual model to grow in functionality and increasing specification. The end result is a well-understood, credible representation of that system, capable of augmenting developmental and operational testing. This same model can then be passed to the in-service and training commu-

nity for use during deployment and Pre-Planned Product Improvements. Although the level of abstraction of the basic model may change from application, a pedigree is established based on a common system representation that becomes the standard for any application. Hence, an adaptive life-cycle tool evolves for the program manager.

Program managers then, gain the benefit of a readily available engineering model of the system that assists in the design and development process, and is reusable and interpretable, not only with other elements of the overall system, but with the entire technical and operational community. Regardless of the design agent, laboratory, field activity, or Fleet installation, the foun-

Shea is the Deputy Director for Modeling and Simulation, Program Executive Office, Theater Air Defense (PEO[TAD]), Systems Engineering Division, Arlington, Va. A Department of Navy employee since 1989, Shea previously worked at Headquarters, Naval Sea Systems Command (NAVSEA), where she supported the test and evaluation community as a weapons systems engineer, providing on-site support to the Fleet, at sea and at shore-based installations.
Pobat is the Integrated Ship Defense Program Manager, Weapon Systems Division, for Litton/PRC, Inc., located in Arlington, Va. For the past five years, his work with the Navy's PEO(TAD) has included Ship Self Defense investment strategy development and modeling and simulation. Pobat previously spent 10 years in the Navy as an Electronic Warfare Technician, with tours aboard the U.S.S. Biddle (CG-34), U.S.S. Austin (LPD-4), and U.S.S. Sterett (CG-31). Homeported in Subic Bay Philippines for two years, he also completed tours at various stateside shore stations.

dation exists for the operation of and interaction between the system models. When you begin to think of the flexibility SBA allows and the time it can save, the payoffs become evident. Ultimately, SBA enables us to develop, field, and support the best products to the operational community in a more cost-effective way.

Current technology can support this revolution. Now is the time for the acquisition community to be creative and integrate this technology with sound engineering practices.

Selection of the Pilot Program

In 1995, the Program Executive Office (Theater Air Defense) (PEO[TAD]) Technology Directorate proposed a set of Advanced Distributed Simulation (ADS) Pilot Programs that was, in part, prompted by the 1994 Naval Research Advisory Committee (NRAC) study. The NRAC study endorsed the use of ADS in support of the acquisition process and stated that "DoN [Department of Navy] acquisition that would provide good candidates for Distributed Simulation Based Acquisition (DSBA) are mine countermeasures, sea-based Theater Ballistic Missile Defense (TBMD), and Ship Self Defense." Based on these differing mission areas, the PEO(TAD) proposed three specific programs as potential pilot programs: Integrated Ship Defense (ISD), TBMD, and Overland Cruise Missile Defense. Ultimately, the Navy selected the ISD Pilot because it represented the most mature and current Fleet sensor/ weapon system.

In May 1996, the Office of Naval Research tasked PEO(TAD) to further develop the ISD Pilot Program concept and provide a detailed program plan. A team consisting of representatives from PEO(TAD), Naval Surface Warfare Center Dahlgren, Naval Research Laboratory, Johns Hopkins University/Applied Physics Laboratory, the Mitre Corporation, and PRC Inc., provided the necessary subject matter experts for the task. Completed in September 1996, the ISD Pilot Pro-

The sneaker net is literally the human-in-the-loop, which hand-carries the results of one model to the operator of the next. This process is labor- and time-intensive and does not capture many benefits inherent in the SSDS and QRCC.

gram Plan provides the detailed technical and programmatic aspects. To generate support and solicit feedback on the proposed ISD Pilot Program, the team conducted a series of key briefings to solicit feedback, guidance, and support from key DoD/DoN senior civilian and military personnel. As a result, they gathered enough information from the following offices to transform the Pilot Program Plan into an executable program:

- Office of the Secretary of Defense (OSD) Director of Research and Engineering
- OSD Director of Test Systems Engineering and Evaluation
- Assistant Secretary of the Navy for Research, Development, and Acquisition (C^{4}I)
- Defense Modeling and Simulation Office
- Chief of Naval Operations
- Director of Navy Test and Evaluation and Technology Requirements (N091)
- Navy Modeling and Simulation Office (N6M)

ISD Program Description

The Chief of Naval Operations approved a plan for development of a Quick Reaction Combat Capability (QRCC) to improve defenses against anti-ship cruise missiles for non-AEGIS ships, and to assure greater survivability for ships operating in harm's way.

To effectively defend against an increasingly stressing cruise missile threat, the operator requires an automated detect-through-engage capability with reduced reaction time. The operator then has the capability to associate and correlate multi-sensor data to provide a sensor-fused composite track that assures a high level of certainty in target identification and classification. Use of flexible doctrine that supports layered defense engagements provides the operator automated control of the system functions and actions. Once the system presents and displays the information such that the operators have an accurate, precise, and comprehensive picture of the tactical situation, the operator can then override, abort, or alter doctrine as necessary. Ultimately, the intent is to provide a fully automated ISD capability.

The ISD combat system provides automated detection-control-engagement by integrating existing stand-alone weapons and sensors via the Ship Self Defense System (SSDS) MK-1. Such integration involves a series of automated actions/reactions:

Figure 1. The "Sneaker Net"

Figure 1. The "Sneaker Net"
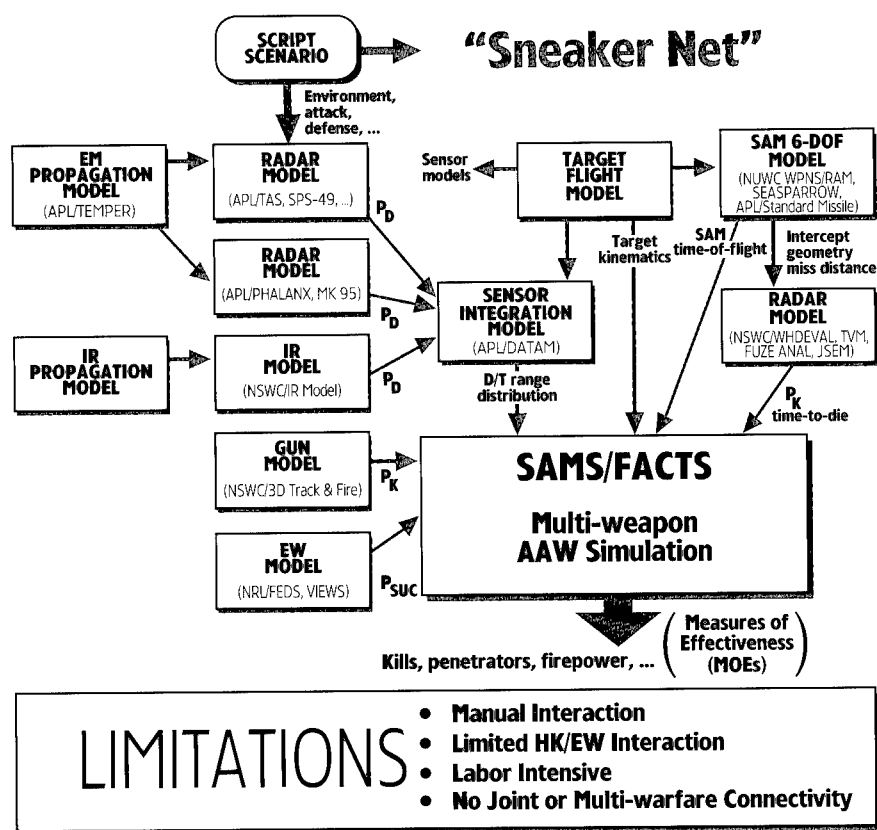
- Existing sensors detect targets and provide track data to distributed track file processors via a Local Area Network (LAN).
- Each track file processor correlates and associates track data for use by the SSDS in Sensor Integration and Control processors, which assign and manage common track file numbers.
- The Local Command and Control processor determines target identification, classification, and appropriate action.
- The Weapon Integration and Control processors manage scheduling. Providing a layered defense that ensures the best employment of hardkill and electronic warfare (HK/EW) segments, these processors automatically determine the weapon(s) mix required to defeat the threat.

Current ISD M&S Capability

The ISD Pilot Program includes a federation of interactive hi-fidelity models built upon and from the existing fami-

ly of credible, authoritative (although primarily stand-alone) ISD M&S. Separate program offices originally developed these legacy M&S to aid engineers in design, development, test and evaluation (performance prediction), and planning. With the formulation of the ISD program office and a focus on the integrated combat system operation, a need surfaced to integrate the models as well. A team of subject matter experts from various laboratories and government facilities manually integrate the models and conduct combat-system-level analysis such as Program Objectives Memorandum investment strategies; cost and operational effectiveness analyses (COEA) or Assessment of Alternatives (AOA); and selected ship-class performance capability studies. This manual integration is known as "the Sneaker Net" (Figure 1).

The sneaker net is literally the human-in-the-loop, which hand-carries the results of one model to the operator of the next. This process is labor- and

time-intensive and does not capture many benefits inherent in the SSDS and QRCC. The current M&S capability, although sufficient for the applications mentioned, does not provide the level of fidelity and operational realism required for the SBA environment (i.e., common battlespace, reactive threat, jamming, realistic equipment availability, hi-fidelity modeling of Electronic Warfare/Infrared (EW/IR), Hardkill/Electronic Warfare (HK/EW), and common standardized databases that are usable by all interactive simulations).

The demand for more operationally realistic M&S capability (e.g., threats, system availability, environment, etc.), a deeper understanding of HK/EW layered defense, and a means of integrating geographically distributed engineering models and subject matter experts, highlight the need for a new approach to M&S.

ISD Technical Issues

The ISD Pilot Program addresses the shortfalls of the existing M&S capabilities (i.e., the Sneaker Net). Improvements incorporate reactive threats and operational environments to increase the realism and credibility of the results. As a first step, it builds upon an established set of existing engineering-level models with known capabilities, by linking them together via a High Level Architecture-compliant Run-Time Infrastructure (RTI). Ultimately, the ISD Pilot Program must address the following technical issues:

- Evaluate and quantify weapons and threat interaction (performance) with the environment (reactive threat, dual mode RF/IR).
- Evaluate and quantify weapons interaction (performance) with the threat.
- Evaluate and quantify sensors' interaction with threat and environment.
- Evaluate and quantify HK envelopes for probability of kill.
- Evaluate and quantify HK and EW weapons interactions and effectiveness.

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- Generate accurate and repeatable system analysis data for ISD verification and isolation of problems.
- Evaluate and quantify system effectiveness using performance measures.
- Create a common-usage, controlled environment for demonstration of system modifications and standardization of threat, environment, and scenario representations.

Program managers must address and solve these technical issues through a thorough understanding of the capabilities, limitations, and interactions of a number of diverse weapons and sensors in complex land, sea, and littoral environments. To evaluate system performance, hi-fidelity, physics-based engineering simulations must reflect these complex system interactions as well as dynamic environmental effects. Consideration of these interdependencies between sensors and weapons; weapons and threats; and between sensors, weapons, and the environment, dictates a departure from the traditional isolated system and subsystem engineering analyses and simulations.

In the past, program managers studied these interdependencies in the real world, through expensive exercises and testing. Regrettably, in many cases the complexity of today's weapons systems surpasses the affordability of complete testing in real-world exercises. The simulations proposed for the ISD Pilot Program will provide the capability to conduct a large part of these analyses and evaluations without expending costly ship, personnel, and test and evaluation resources, and lay the groundwork for advancing SBA initiatives.
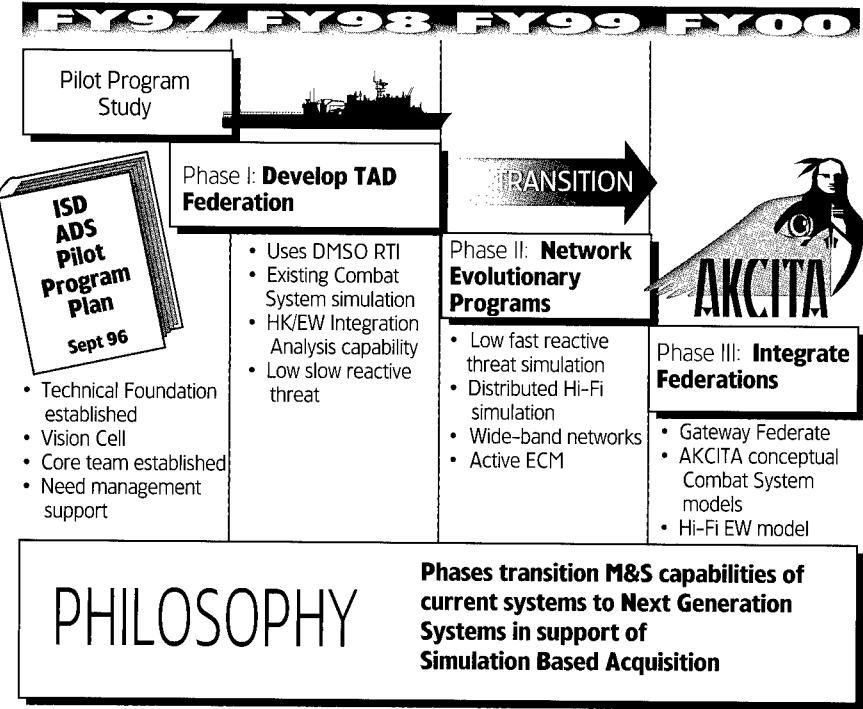
ISD Pilot Program Overview

The goal of the ISD Pilot Program is to develop and demonstrate a comprehensive M&S capability that supports the design and evaluation of components and systems, which further support SBA initiatives. The ISD ADS Pilot Program will be conducted over a period of three years. Each phase will retain its own set of objectives; however, each phase will build on the capabilities demonstrated in the preceding phase. Figure 2 shows the three phases of the program and the evolving capabilities. The goal is to increase the sim-

ulation set and proceed toward the eventual implementation of the superset of simulations. A brief description of each phase follows.

Phase I

The development team intended that this initial phase provide a benchmarking opportunity in the development of ISD Federation. Accordingly, the system designers, modelers, and testers will be addressing the complex issues inherent to test and evaluation. Of particular interest is the ability to perform HK/EW integrated modeling in a distributed environment using a High Level Architecture-compliant RTI. For this reason, the approach is conservative and is tailored to achieve the greatest capability in a one-year time period. This time period will still permit the development team to gain the experience needed to accomplish more complex configurations in subsequent phases. To minimize risks, the simulations will be developed at the developer's site. The integration, however, will be accomplished in a single laboratory, with the simulations interconnected via RTI, but using a LAN. The products of Phase I are —

- first-time, hi-fidelity detect-through-engage simulation capability;
- hi-fidelity, integrated HK/EW assessment capability;
- threat reactive-common to all combat system elements;
- contribution to Joint Synthetic Test and Evaluation battlespace;
- established foundation for Phases II and III;
- PEO(TAD) established as a beta test site for Defense Modeling and Simulation Office RTI; and
- verification and validation of federation.

Figure 3 depicts the architecture for Phase I development.

Phase II

The intent in Phase II is to use the experience gained in Phase I to greatly increase the capability of the federation through the incorporation of additional federates. This com-

Figure 2. **Evolving Capabilities**

FY97 FY98 FY99 FY00

Pilot Program Study

ISD ADS Pilot Program Plan Sept 96
- Technical Foundation established
- Vision Cell
- Core team established
- Need management support

Phase I: **Develop TAD Federation**
- Uses DMSO RTI
- Existing Combat System simulation
- HK/EW Integration Analysis capability
- Low slow reactive threat

TRANSITION

Phase II: **Network Evolutionary Programs**
- Low fast reactive threat simulation
- Distributed Hi-Fi simulation
- Wide-band networks
- Active ECM

Phase III: **Integrate Federations**
- Gateway Federate
- AKCITA conceptual Combat System models
- Hi-Fi EW model

AKCITA

PHILOSOPHY — **Phases transition M&S capabilities of current systems to Next Generation Systems in support of Simulation Based Acquisition**

Figure 3. Phase I Architecture

LSD 41 Class

ESM RAM CUE
CIWS
SPS-49 (MPU)
SPS-67 / **DETECT**

SSDS / **CONTROL**

PASSIVE DECOYS
CIWS
RAM BLK 0 / **ENGAGE**

EM SIGNATURE
SHIP'S MOTION / **OWNSHIP DATA**

Run Time Infrastructure (RTI)

ENVIRONMENT
EM PROPAGATION

REACTIVE THREATS
LOW SLOW (RF)
TEST ASSETS

CONTROL & ANALYSIS
SIMULATION CONTROL
COLLECTION/ANALYSIS

- **First time HK/EW assessment capability against reactive threat**
- **Demonstrate federation of hi-fidelity models**
- **Benchmark capability for follow-on applications**

plexity will enable a close examination of sensor integration and will permit a systematic approach to the investigation of HK/EW coordination. Models involved in this phase will reside at the developer's site and will

be interconnected, through the RTI, via a geographically distributed network.

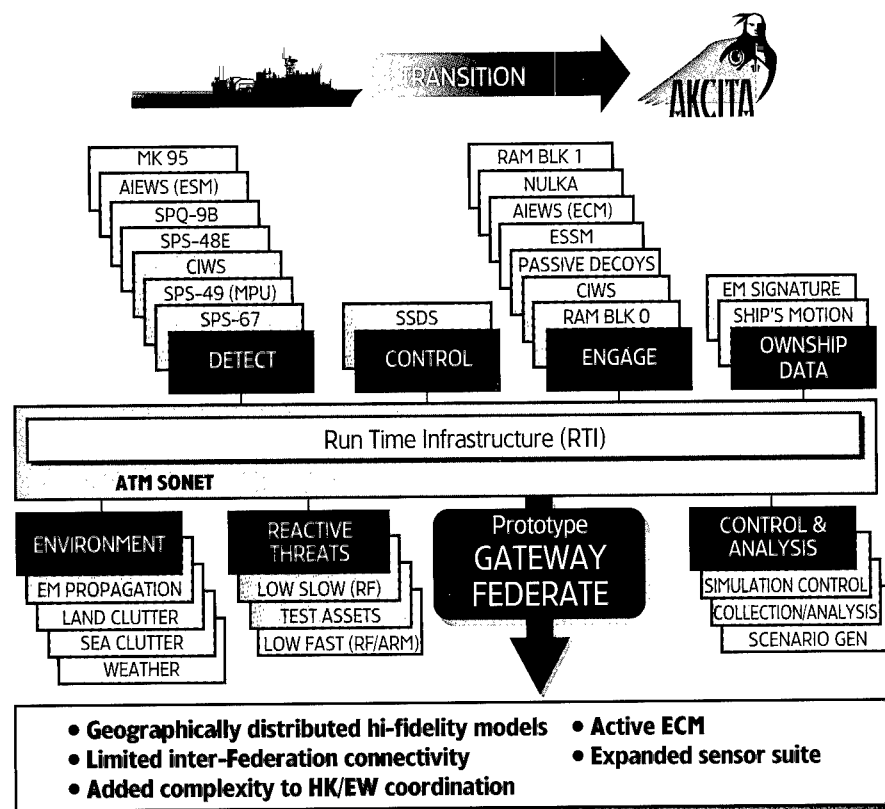Additional reactive threats will be added in this phase. The intent is to

Figure 4. Phase II Architecture

TRANSITION → **AKCITA**

MK 95
AIEWS (ESM)
SPQ-9B
SPS-48E
CIWS
SPS-49 (MPU)
SPS-67 / **DETECT**

SSDS / **CONTROL**

RAM BLK 1
NULKA
AIEWS (ECM)
ESSM
PASSIVE DECOYS
CIWS
RAM BLK 0 / **ENGAGE**

EM SIGNATURE
SHIP'S MOTION / **OWNSHIP DATA**

Run Time Infrastructure (RTI)

ATM SONET

ENVIRONMENT
EM PROPAGATION
LAND CLUTTER
SEA CLUTTER
WEATHER

REACTIVE THREATS
LOW SLOW (RF)
TEST ASSETS
LOW FAST (RF/ARM)

Prototype **GATEWAY FEDERATE**

CONTROL & ANALYSIS
SIMULATION CONTROL
COLLECTION/ANALYSIS
SCENARIO GEN

- **Geographically distributed hi-fidelity models**
- **Limited inter-Federation connectivity**
- **Added complexity to HK/EW coordination**
- **Active ECM**
- **Expanded sensor suite**

add threats whose performance can stress the capabilities of the ISD combat system. In this way the federation can be used to explore reaction times of different combat system configurations to stressing situations. This will also permit an evaluation of the federation and its capability to simulate real-time operation. The products of Phase II are —

- active electronic attack assessment;
- realistic representation of operational environment;
- geographically distributed simulation using Asynchronous Transfer Mode/Sonet Network;
- network technology that provides feasibility of a re-use tool;
- verification and validation of federation; and
- additional threat families represented.

Figure 4 depicts the architecture for Phase II development.

Phase III

The intent of Phase III is to produce a federation that provides a capability to model conceptual systems of the next generation combat system — Akcita. This will enable the federation to support SBA initiatives for future acquisition programs.

To provide a realistic operational environment, this phase will complete the addition of propagation, clutter, and weather models to achieve a dynamic multispectral environment. This will enable the examination of both Radio Frequency (RF) and Infrared (IR) threats in a stressing environment. To provide detection of these dual-mode threats, this phase also adds an IR sensor.

The Gateway Federate will be employed and tested in this phase, enabling communication and interaction between two federations of differing levels of fidelity and resolution. The intent is to link the ISD Federation to the Joint Countermine Operational Simulation (JCOS) Federation to simulate a multi-warfare exercise.

This would permit inter-federation communications between a federation operating with engineering-level simulations and a federation operating at an engagement simulation level (i.e., lower fidelity). Phase III products include —

- IR sensor, environment, and threat modeling;
- conceptual ship and combat system models;
- advanced threat models (full complement of ISD threat representative models);
- advancement of SBA initiatives through multi-fidelity simulation;
- inter-federation linking (Gateway Federate); and
- verification and validation of federation.

Figure 5 depicts the architecture for Phase III development.

Value-Added and Support to Acquisition Program Manager

The tools resulting from completion of the Pilot Program have the potential to enhance the system acquisition process by adding value in the following areas:

- **AOA.** The federation of ISD analytical models can be used to determine operational effectiveness against specified threats as part of an AOA Study.
- **Mission.** As a means of developing a Requirements Definition, the simulations provide a means for quantitative evaluation of measures of effectiveness and performance prior to verifying system requirements.
- **System Engineering.** The Interactive ISD Federation will provide a mechanism for developing and exercising a prototype system in a simulated environment. This will, in effect, create a laboratory for trying out a design or an engineering change proposal, before its approval as an engineering requirement.
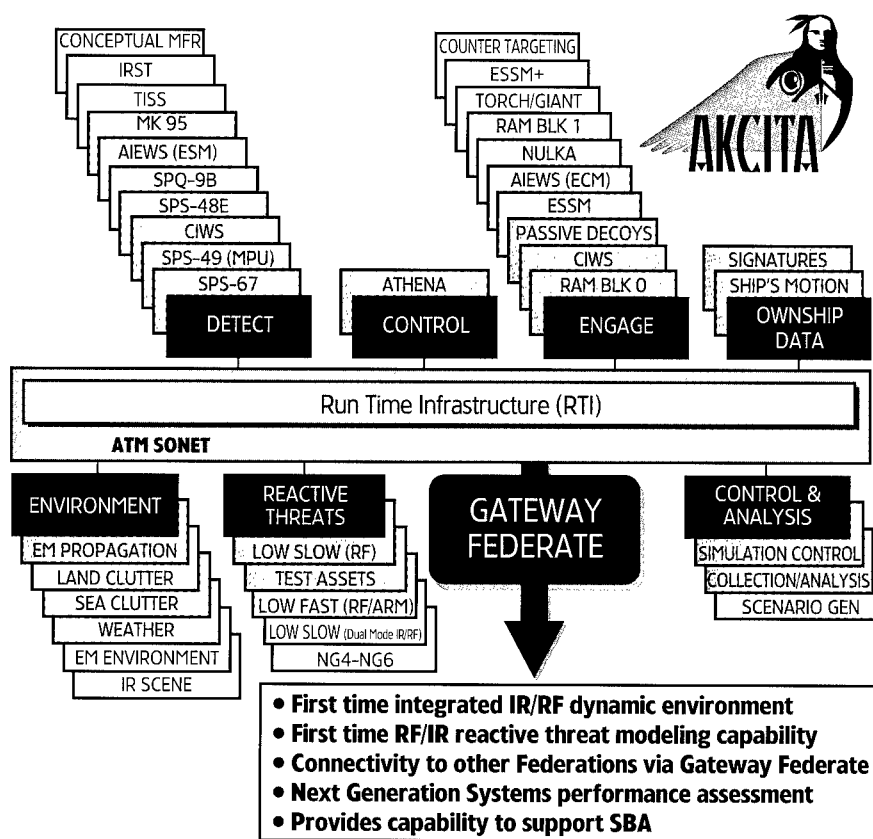- **Design and Analysis.** The simulations provide a mechanism for the

collection of performance data as a basis for design of system modifications. A significant feature is the ability to conduct repeatable test conditions, and the capability to parametrically vary the conditions in a controlled manner.

- **Testing and Evaluation.** The ISD Federation will provide a virtual simulation capability that will enhance test and evaluation efforts by providing better-designed systems as a result of testing earlier in the development phase. A wider scope of testing may be possible for some systems, especially those that require large scenarios of costly test services, such as multiple aircraft flyovers or test targets and associated range services.
- **Doctrine and Tactics.** The ISD Federation will provide a method to evaluate the tactics and doctrine by exercising the prototype ISDS human-machine interface in conjunction with the simulated sensors and weapons.

Bringing M&S Into Focus

The key issue for program managers to understand is that as M&S is brought into focus DoD-wide, the real return on investment will be realized. Because of declining budgets and technically advanced systems, we can no longer continue business as usual and expect to field the same quality systems. We must rely more on the benefits M&S can provide, but first we need to lay the foundation that makes that possible. Program managers need to have a high degree of confidence in their models and the subject matter experts to operate them. The key is to get started, take a small piece of the problems, and work from there. The momentum of success and opportunity to leverage from other's work will carry the effort forward. Every effort toward this goal helps by bringing M&S into clear focus for the acquisition community.

Figure 5. **Phase III Architecture**

- **First time integrated IR/RF dynamic environment**
- **First time RF/IR reactive threat modeling capability**
- **Connectivity to other Federations via Gateway Federate**
- **Next Generation Systems performance assessment**
- **Provides capability to support SBA**

Integrated Acquisition-Logistics Synthetic Environments for Total Value Assessment

Reuse and Interoperability of Virtual Products Key to Payoff on a National Scale

GARY JONES • HENSON GRAVES • MARK GERSH

otal Value Assessment for the acquisition, delivery, provisioning, and sustainment of warfighting forces requires a greater understanding of how these processes develop, interrelate, and evolve in real-world situations. These processes are complex and tend to depend upon an immense amount of data. In many cases, small changes in the environment produce large discontinuous changes in the way the processes work. For example, estimating the amount of supplies needed for Desert Storm, actually shipping them, and returning the unused items afterward stressed our ability to predict and control the supply process, and resulted in quite a few undesirable ripple effects.

Vision

Creating models for acquisition-logistics processes and simulating their execution within a synthetic environment provides the best tool available for assessing the total value of products and their associated processes. Within a synthetic environment, we can instrument and monitor an unfolding process and its constituent product(s) to gather data for later analysis; or in real time, interactively ask "what-if" questions by making adjustments to the product(s) and process(es) to better understand resultant behavior.

Creating models for acquisition-logistics processes and simulating their execution within a synthetic environment provides the best tool available for assessing the total value of products and their associated processes.

"ESTIMATING THE AMOUNT OF SUPPLIES NEEDED FOR DESERT STORM, ACTUALLY SHIPPING THEM, AND RETURNING THE UNUSED ITEMS AFTERWARD STRESSED OUR ABILITY TO PREDICT AND CONTROL THE SUPPLY PROCESS, AND RESULTED IN QUITE A FEW UNDESIRABLE RIPPLE EFFECTS." PICTURED IS A WAREHOUSE AT THE PORT OF JEDDAH, SAUDI ARABIA, CONTAINING SUPPLIES FOR OPERATION DESERT STORM. THE SUPPLIES WERE LOADED ONTO MILITARY SEALIFT COMMAND SHIPS FOR TRANSPORT TO THE THEATER OF OPERATIONS.

A major DoD Modeling and Simulation (M&S) objective is to perform virtual warfare engagements using simulated and actual weapon systems. This vision and its objectives can be broadened to include the acquisition and logistics processes of simulated and actual systems. For example, a logistics planning exercise using weather and climate data may link to actual operational supply vessels and into

commercial transport systems so as to assess the trades of augmenting DoD systems with commercial delivery systems. Imagine if this same exercise included connections to models and simulations of the transported products so the issues of retrofit and manufacturing could also be addressed, giving logisticians an even more complete or total value assessment of all options.

Achieving the Vision

Achieving the vision of integrated acquisition and logistics synthetic environments still presents a number of technology challenges. Before vir-

tual engagements can be of most value to life-cycle analysis, they will require high-fidelity system models. During the course of analysis, we need an ability to refine components of high-level aggregate models into detailed high-fidelity models to better explore specific aspects of a life-cycle problem. M&S is already used for planning and warfare analysis at different levels of abstraction (campaign, engagement, and system interoperation); however, current M&S systems have little ability to integrate

multiple-fidelity models into a simulation exercise.

No single organization will be able to build and maintain the collection of virtual prototypes needed for these exercises. Since prototypes will be built and used by many different organizations, achieving interoperability requires the use of at least de facto standards and perhaps an organization to promulgate those standards. Currently, some standards are beginning to emerge for representing virtual prototypes. For example, modelers explicitly designed Virtual Reality Modeling Language (VRML) to produce virtual prototypes that can be placed in synthetic worlds and interact with other objects in these worlds. This emerging technology needs to be integrated and more exploited within the acquisition-logistics community.

Constructing and performing assessment exercises in a synthetic environment requires a distributed modeling and simulation framework in which a user can discover and configure virtual prototypes, then launch exercises without human involvement at any of the distributed sites that contain prototypes. Commercial technology and standards that address tool-to-tool communication (e.g., Common Object Request Broker Architecture [CORBA], Internet protocols) are available and can be exploited for the assembly of distributed synthetic environments.

SBD's Influence/Accomplishments

The Defense Advanced Research Projects Agency Simulation Based Design (SBD) program is developing a prototype distributive, collaborative software system that addresses some of the functions required for fielding the types of integrated acquisition-logistics synthetic environments that support the development, analysis, and interoperation of virtual prototypes.

Previously, DARPA's SBD program validated the feasibility of establishing distributed synthetic collaboration environments between multiple heterogeneous organizations. To meet

new threats, these collaborative synthetic environments used *engineering* analysis to better evaluate operational warfighting performance and used operational analysis to reengineer weapon systems.

Engineers also used SBD to develop conceptual design models and detailed engineering models for ships. Of sufficient structural detail that modelers can use them for parametric design optimization, the conceptual models can be placed in high-fidelity operating environments. The detailed models have been used to generate shop floor manufacturing instructions and to provide immersive maintenance training.

During the past year, the SBD program performed a validation experiment, called the Advanced Surface Combatant (ASC), that culminated in a February 1997 demonstration of SBD maturity. This experiment specifically focused on the survivability analysis and redesign of a surface combatant to meet a new threat. It also provided the opportunity to include detailed physics-based models in the warfighting analysis phase and use of multidisciplinary optimization techniques to provide parametric design information to the redesign process.

The ASC Experiment resulted in an SBD system configuration that —

- integrated multiple companies and government agencies into an Integrated Product Team (IPT);
- organized the IPT as a hierarchical collection of federations;
- operated over a combination of Local Area Network, Internet, and DARPA gigabit testbed (ATDNet) network resources;
- integrated approximately 30 software components into the system;
- integrated two legacy databases and ingested the indicative design of the Navy SC-21;
- provided interface code that wrapped legacy simulations making them compliant with the DMSO High Level Architecture;
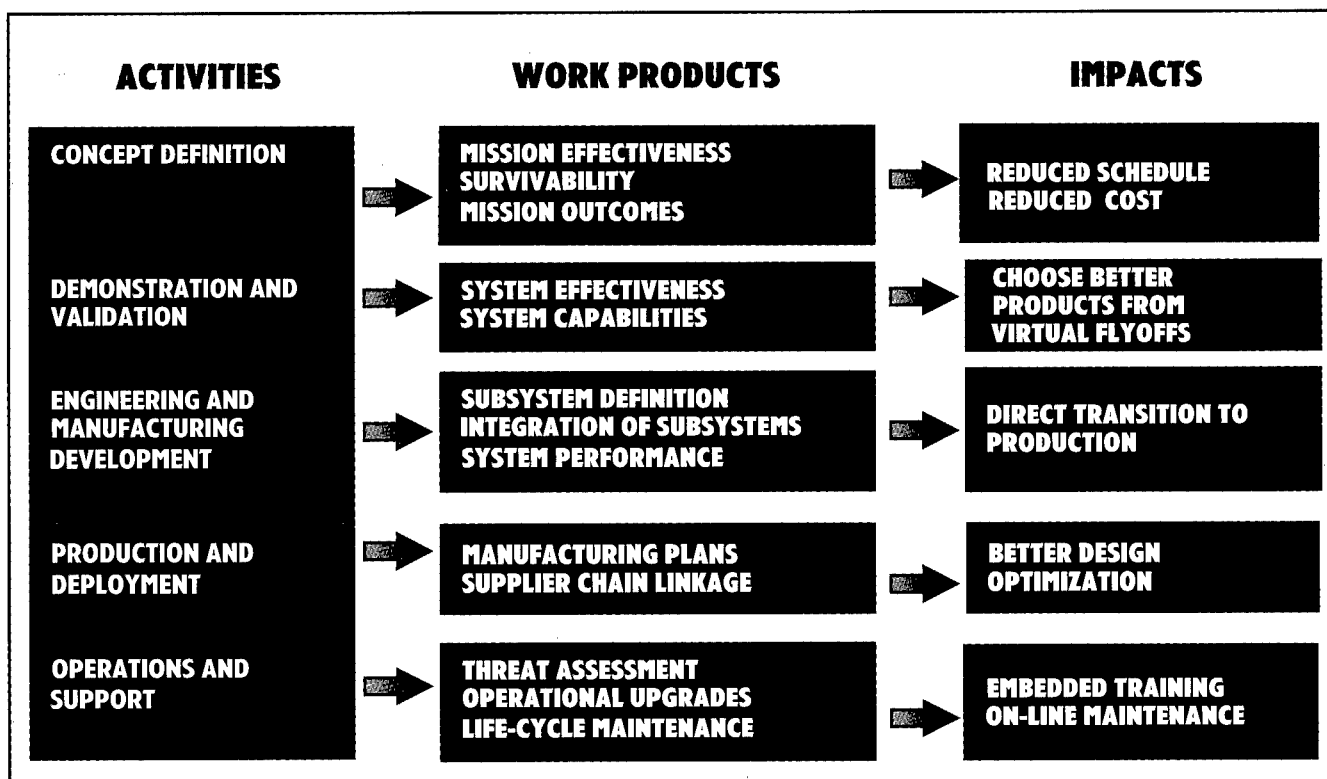
ACTIVITIES	WORK PRODUCTS	IMPACTS
CONCEPT DEFINITION	MISSION EFFECTIVENESS SURVIVABILITY MISSION OUTCOMES	REDUCED SCHEDULE REDUCED COST
DEMONSTRATION AND VALIDATION	SYSTEM EFFECTIVENESS SYSTEM CAPABILITIES	CHOOSE BETTER PRODUCTS FROM VIRTUAL FLYOFFS
ENGINEERING AND MANUFACTURING DEVELOPMENT	SUBSYSTEM DEFINITION INTEGRATION OF SUBSYSTEMS SYSTEM PERFORMANCE	DIRECT TRANSITION TO PRODUCTION
PRODUCTION AND DEPLOYMENT	MANUFACTURING PLANS SUPPLIER CHAIN LINKAGE	BETTER DESIGN OPTIMIZATION
OPERATIONS AND SUPPORT	THREAT ASSESSMENT OPERATIONAL UPGRADES LIFE-CYCLE MAINTENANCE	EMBEDDED TRAINING ON-LINE MAINTENANCE

Figure 1. **Product Life-Cycle Activities, Work Products, and Impacts**

• demonstrated the use of SBD in multiple life-cycle activities (from requirements to training);
• demonstrated the use of multidisciplinary analysis and optimization; and
• incorporated cost as an independent variable in the design trades.

The ASC experiment represented a significant achievement in maturing SBD technology to the stage that it can now be deployed for experimental use by contractors and the government for conceptual system design, development, and evaluation.

The SBD Product
The SBD system is a collaborative, multidisciplinary environment for developing and using virtual/real prototypes. Engineers configure an SBD system for a specific application by linking copies of a common set of software, called the Core Processing System, together with application-specific software tools. SBD allows engineers to develop, analyze, and operate virtual prototypes as they would actual prototypes, but without the cost and

complexity associated with real hardware and materials. A virtual prototype is a computer software module that models the structure and behavior of the actual product under development. The process of producing an actual product proceeds as a series of virtual prototypes that defines the product and/or generates manufacturing instructions for the product. For the virtual prototyping process to yield actual quality products, the same disciplines must be applied in the virtual prototyping process as are applied in conventional product development processes.

Numerous integrated development environments exist, tailored to a selected computer-aided design (CAD) tool (e.g., the Boeing 777 CATIA™-based environment), and many organizations have now integrated modeling, simulation, visualization, and analysis tools for product development. However, engineers craft these concurrent engineering systems for specific applications, which significantly limits their reusability, even between different projects in the same

organization. Developing the second system becomes as expensive as developing the first. Further, there are no standards to allow these different systems to interoperate.

The SBD process employs a much more open approach that produces a variety of design, engineering, and evaluation results. Figure 1 illustrates the product development activities, SBD work products, and their impact on the product life cycle. This process delivers better quality products at a reduced cost, risk, and schedule when compared to the current, more conventional concurrent engineering approaches. The virtual prototyping activities can be conducted in a distributed collaborative software environment, which allows more concurrence in the development tasks, thus reducing schedule slippage.

Using virtual prototypes for engineering analysis and operational validation also allows for investigation of larger solution spaces. Changes can be made much later in the virtual product development life cycle without incur-
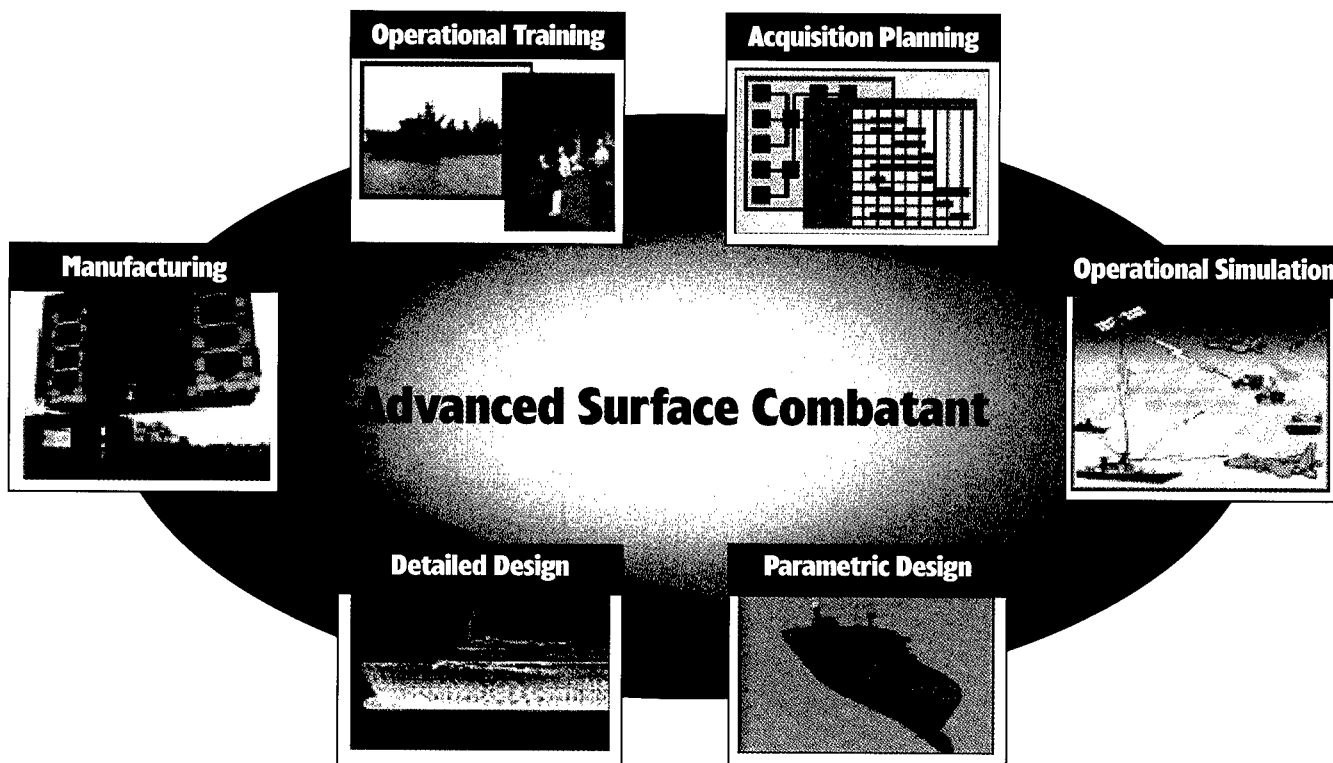
Figure 2. **SBD Integrates Multidisciplinary Life-Cycle Activities**

ring the cost magnitude that changes further downstream make in conventional development processes.

Figure 2 illustrates the life-cycle activities for a notional ASC Navy program, integrated and supported by a collaborative SBD system configured as an IPT. The IPT involved multiple government and contractor organizations with participants for program management, design, engineering analysis, operational test and evaluation, and deployment and training.

The ASC SBD system linked multiple copies of the common software components together to support the IPT. Engineers configured each participant's software to reflect one of the following four roles in the life-cycle development process:

- Program Management Office
- Hull Mechanical and Electrical Design
- Combat System Design
- Survivability Analysis

While some of the ASC software was ship-specific, much was domain-inde-

pendent and could be used for other application areas. The experience of integrating such an SBD system translates readily to other domains.

Using SBD

With SBD, a user can define, modify, visualize, and manipulate virtual products. The SBD system coordinates the management between multiple user activities by using virtual prototypes that are composed as assemblies of subsystems and parts. Engineers define the actual construction of parts in terms of material, structure, and behavior attributes. By combining legacy models in various ways and by producing data that can be used by a variety of legacy analysis tools, they construct virtual products. The values then, of these attributes may be computed by external tools or incorporated from legacy databases.

Users access SBD through a standard web browser. Figure 3 shows a satellite prototype as viewed from an early SBD User interface prototype. Since a key feature of the user interface is its use of standard web browsers, it can easily

use standard plug-in tools such as VRML viewers to display a wide spectrum of standard data types.

This particular user interface prototype lacks the elements for controlling analysis and design tools, but it does show how engineers can easily access information about the design elements. In this example, the window on the right shows a component hierarchy of the satellite and allows the user to access components like bus structure, power, propulsion, attitude determination and control system, thermal, and payload modules. Each of these components has its own decomposition, and the subcomponents are interconnected in various ways. Connections are maintained as part of the product definition.

The window on the left displays the satellite as viewed within a 3D visualization and interaction environment. This satellite prototype responds to a set of commands that can be used to deploy its solar panels and actuate mechanical devices on the satellite. Operating the satellite within this kind
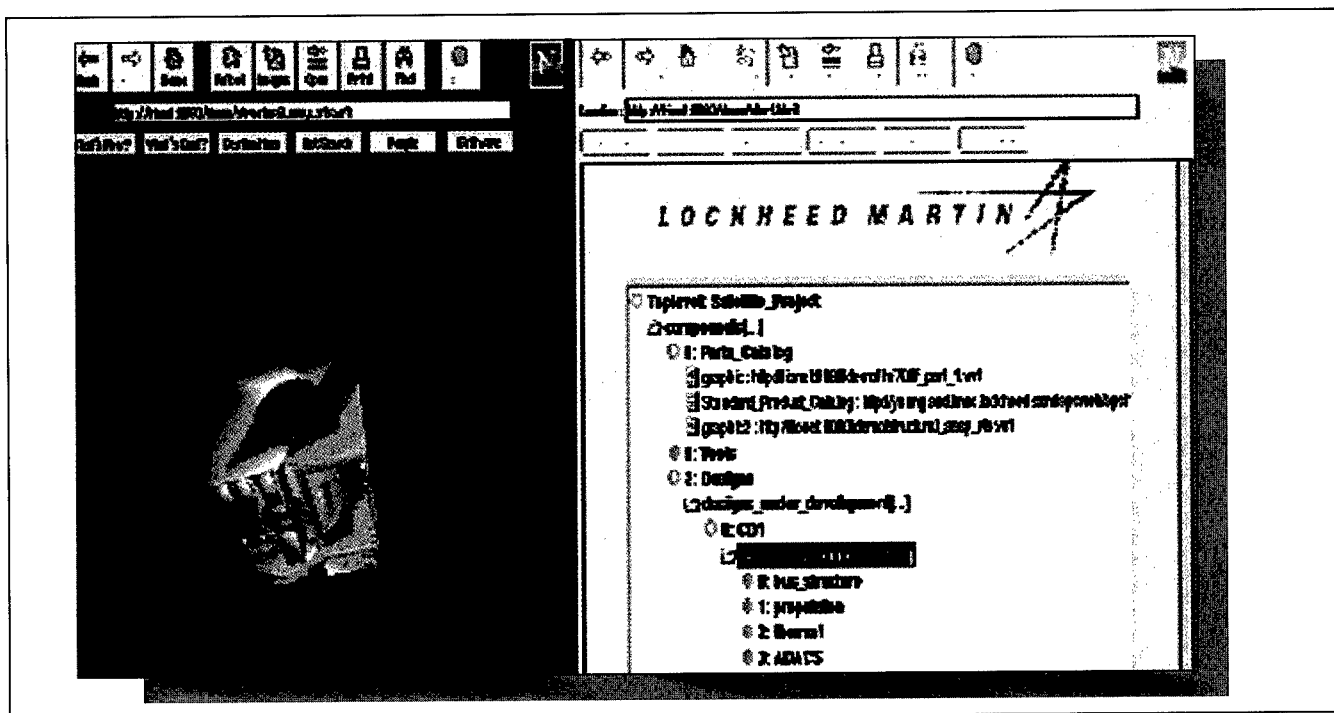
Figure 3. **Satellite Prototype Viewed from the SBD Guided User Interface (GUI)**

of environment can be used to evaluate a number of design properties such as sensor field of view, inter-satellite communications, ground station communications, mechanical interference properties of deployment and actuation devices, and advanced technology insertion. In this example, engineers used VRML to produce the visual appearance of the satellite, with the VRML being computed from the virtual product representation.

The specifics upon which modelers define virtual prototypes differ, depending on the level of fidelity needed and the data requirements of the tools used to evaluate the prototype. Easy to modify and clone, engineers can later reuse virtual prototypes as parts of other prototypes. New attributes (e.g., center of gravity) can also be added to a prototype when needed for a particular application.

Further, engineers can quickly generate an initial conceptual design to validate feasibility and provide a basis for cost estimation by reusing data from previous systems and by importing data from external tools. The virtual products can then be analyzed with existing or legacy analysis tools, and can be operated in virtual environments combining real and simulated products.

With SBD, engineers can also capture design processes, such as the steps in designing a power subsystem for the satellite, as mega-programs — or programs of programs — that are manipulated and operated exactly like the virtual prototypes.

Development proceeds within SBD by establishing product constraints and requirements and by constructing increasingly detailed virtual prototypes of the product. The virtual prototypes (software models) can be viewed, interacted with, analyzed, and operated like real prototypes. As engineers make design changes, analysis and evaluation of the prototypes takes place within synthetic physics-based environments. SBD not only manages these design artifacts, with built-in configuration management tools, but also allows engineers to incorporate components of different levels of fidelity within a virtual prototype.

Collaborating With SBD

Complex product development typically involves multiple heterogeneous organizations. The inter-connectivity needed for product development requires support for defining, managing, and enforcing development processes and the resulting workflow. In a large-scale product development enterprise, each team has its own data, product, and process models.

Since engineers configure a collaborative SBD system as a collection of copies of the common software, it works to provide seamless access to all public resources in the entire SBD system. Each user interface provides access to the rest of the SBD system, as mediated by the Core Processing System components.

SBD allows users to maintain their product data in one or more databases — legacy or new, flat file, relational, or object oriented — which can be either centralized or distributed. Each Core Processing System maintains an object model that is accessed from its user interface, for visualization and interaction.

A Project's View of SBD

SBD uses object models to represent all product and process information. Within an enterprise's organizational hierarchy, object models, collectively called the Smart Product Model
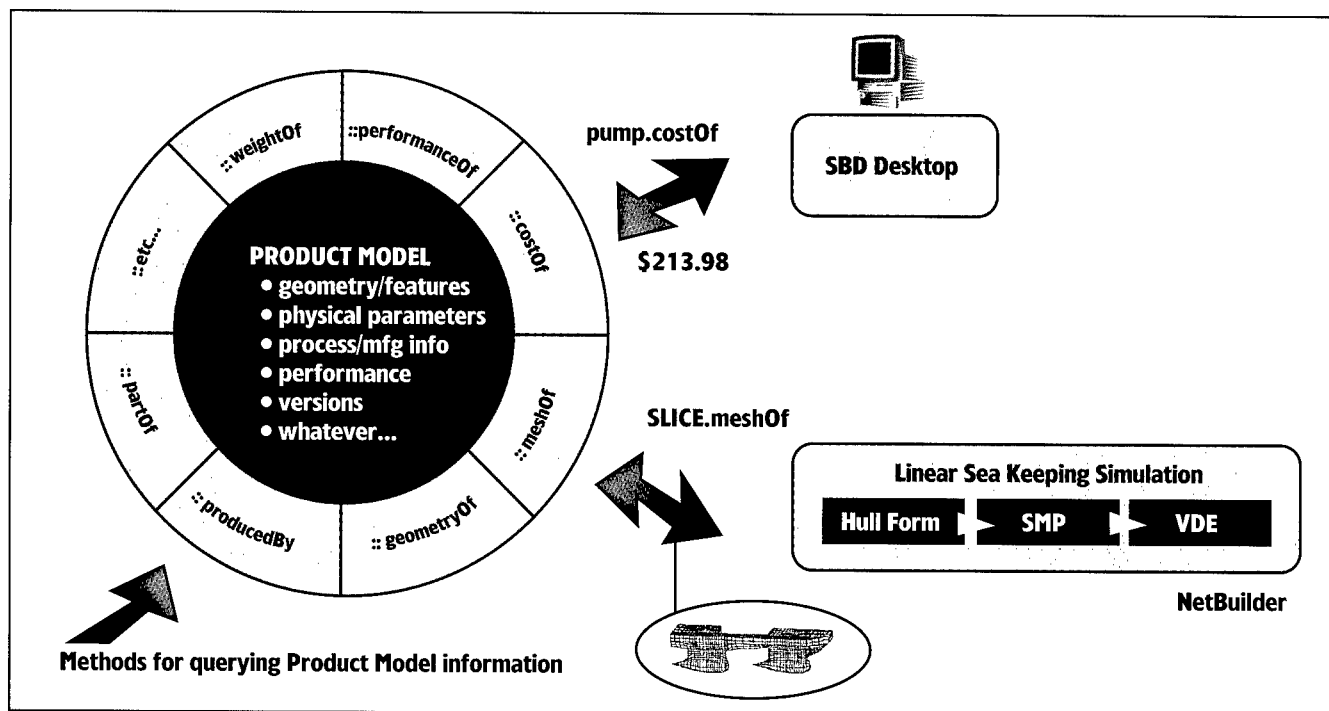
Figure 4. **A Logical View of the SPM**

(SPM), define and manage the development process, the external software and databases that are part of a specific SBD configuration, as well as the product models that engineers develop as part of the life-cycle process.

The SPM may be viewed as a collection of concentric circles with data at the center; "smart" methods that directly operate on the data in the innermost ring; software components that provide value-added services such as 3D viewing and interaction with product model data as the next ring; and finally, external programs that interface to the core data as the outer ring.

Figure 4 illustrates this view of the architecture for a notional ship design project.

This architecture is a natural extension of the single CAD model approach used on large programs such as Boeing 777. Integrating behavior, management, and analysis data into a single virtual enterprise-wide distributed data model ensures that all members of the team always have access to all information relevant to their design, and that the impact of

design or management changes — such as schedules or budgets — can be immediately assessed by all team members.

The object models are "smart" because they have methods that are used to perform analysis and other development activities. Methods are the means to manipulate or analyze data such as meshing of CAD data for structural analysis, aerodynamics for aircraft maneuverability, or a seakeeping model for ship motions. As such, they can be aggregated to form views into the object model that are specific to a given discipline or user group. As an example, methods may be used to calculate the weight of an object as the sum of the weights of its components; or methods can be used to expose a data view relevant to the structural design engineer.

Conclusion

SBD is the first step toward fielding integrated acquisition-logistics synthetic environments. By harnessing advancements in M&S, High Performance Computing and Communications, and Multimedia technologies, SBD provides a virtual collaborative environment for geographically dis-

tributed IPTs to design complex systems and provide support throughout the product's life cycle.

Today, M&S is becoming increasingly important in acquiring systems for the government, but the potential cost reductions offered by correctly using M&S in the design process still dwarf deployed reality. Why hasn't the DoD acquisition community yet realized these substantial cost reductions? The answer is contained in the following three problem areas: tools don't interoperate, people are in the loop even when no decision-making requirements exist, and no standards for digital product and process models exist. SBD offers a solution to these problems by leveraging emerging standards and commercial forces for interoperability, by fielding a collaborative software environment infrastructure, and by creating de facto standards for product and process models.

The SBD program is unique in developing a virtual prototyping architecture for configuring reusable and interconnective SBD systems with standards-based interfaces. The ability to reuse and interoperate virtual products across multiple organizations and vendors is where SBD will pay off on a national scale.

Why is Modeling and Simulation So Hard to Do?

M&S Commonalities, Interoperable Systems Will Provide Warfighters, Decision Makers Increased Readiness Across Full Spectrum of Conflict

RONALD W. TARR

"No one knows exactly what warfare in the 21st Century will be like. However, one thing is certain – future battlefields will be far different and more complex than 20th Century battlefields. We must be ready...Finding ways to exploit our competitive advantages – quality people and advancing technology – becomes our future readiness challenge."

–Gen. Dennis J. Reimer
Army Chief of Staff

The issue of Simulation Based Acquisition poses an interesting dichotomy for the Defense Department and its support industries. On the one hand, it holds the potential to be the greatest tool to improve the acquisition process; but on the other hand, the number of systems and programs using simulation in new, innovative ways are few and far between. Given the enormous pressure to reduce costs, save time, and make innovative uses of technology in all facets of our lives, why does this obvious area of need seem to be lagging behind? It appears that the difficulties are not technological as much as they are cultural, organizational, and yes, even a function of policy.

The Stated Need

The use of modeling and simulation (M&S) in the military and its supporting industries is increasing. As these needs increase, the demand for non-technical personnel to provide management and leadership also increases. The senior leadership of each Service express these needs in their individual M&S plans.

The Army Model and Simulation Master Plan[1] promotes the adoption of M&S standards, common tools, and processes for use in all applications throughout the Army. In an effort to invest its resources in an effective and efficient fashion, the Department of the Army intends to use M&S technologies to significantly advance the capabilities of a smaller, power-projection Army capable of land force domi-

nance.[2] The Master Plan requires that the Army seek opportunities for commonality within M&S technologies and capitalize upon them, wherever feasible.

The U.S. Air Force (USAF) Modeling and Simulation Master Plan states the Air Force goal for M&S is to develop a capability, using interoperable M&S systems, to provide warfighters and decision makers the tools to ensure readiness across the full spectrum of conflict.[3] Fully capable of supporting analysis and training, which is integrated throughout all echelons of the Air Force, the Air Force M&S architecture links together many

types of simulations (e.g., aggregate and detailed computer models, pilots in live aircraft and simulators, and hardware components).

The Air Force has always used models and simulations of reality, considering live field exercises as simulated warfare.[4]

The U.S. Marine Corps (USMC) desires to acquire and apply M&S technologies effectively and efficiently to support USMC roles and missions.[5] Recognizing that the use of M&S enhances training, education, analysis, logistics, planning, and the conduct of operations, the USMC also promotes the use of M&S as the very basis for improving future acquisition decisions, systems testing and evaluation, realignment of force structure, and requirements definition.[6]

The Marine Corps Modeling and Simulation Master Plan states that the Marine Corps will maximize warfighting capability by exploiting world class M&S technology in order to take full advantage of the explosion in information and communications technologies, thereby improving Total Force performance. By ensuring that it simulates before it builds, buys, or fights, the Corps will enhance readiness and training while simultaneously reducing costs.[7]

The Department of the Navy (DON) has stated it will use the appropriate level of M&S in order to support all phases and milestone decisions of the system acquisition cycle.[8] The end-state objectives of the Navy's M&S plan includes a full-scale integration of live, virtual, and constructive simulation into training endeavors, and the enabling of mission planning and rehearsal through the use of M&S.[9]

community. For years, senior acquisition leaders throughout the Department of Defense (DoD) discussed a future goal of streamlining the acquisition process. For people outside the military [and oftentimes, inside], the acquisition life cycle is almost unbelievable. For example, the Air Force began work on the F-14 as early as 1961, the M1 Tank in 1969, and the Stealth Fighter in 1978; in fact, an average acquisition life cycle of 15 years for even small systems is not unusual. The need to streamline is great, and the process has many points that would seem to warrant some technological improvements. Let's look at a few.

Concept Formulation/Defining Requirements. We're all familiar with the cartoon that shows the series of events illustrating how the camel evolved via
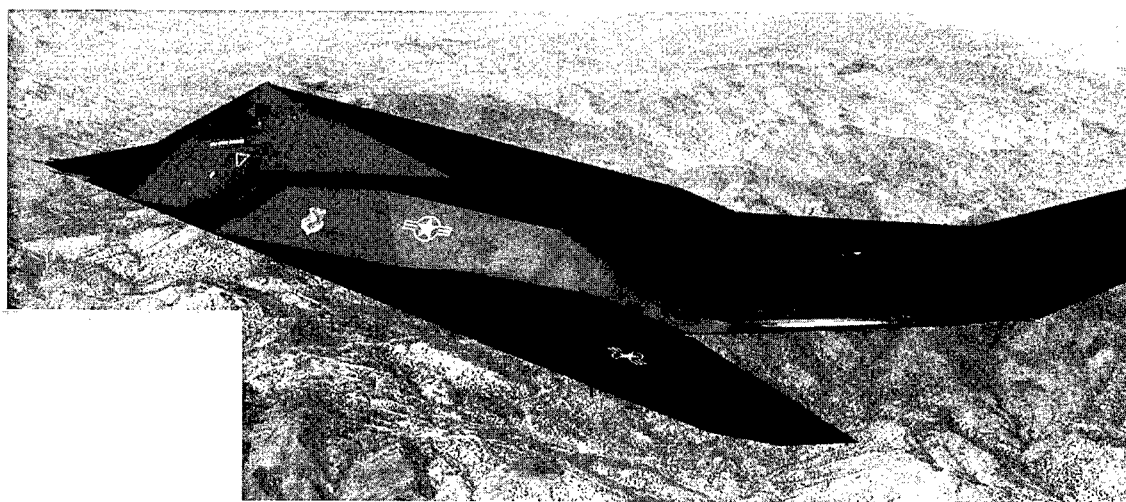
Photo courtesy Lockheed Martin Corporation

"FOR PEOPLE OUTSIDE THE MILITARY [AND OFTENTIMES, INSIDE], THE ACQUISITION LIFE CYCLE IS ALMOST UNBELIEVABLE. FOR EXAMPLE, THE AIR FORCE BEGAN WORK ON THE F-14 AS EARLY AS 1961, THE M1 TANK IN 1969, AND THE STEALTH FIGHTER IN 1978; IN FACT, AN AVERAGE ACQUISITION LIFE CYCLE OF 15 YEARS FOR EVEN SMALL SYSTEMS IS NOT UNUSUAL."

The Solution

The intent of all the Services and, in many cases, the Congress, seems quite clear, and many of us believe that the domain of M&S that could gain the most from this new technology is the acquisition

the acquisition process, when a horse was the original concept. Although a trite example, it does typify what we all experienced, as the user first describes the need and then passes it to the developer, who must then convert the idea into the best technical solution. The challenge is for the user to initially communicate the needed system in operational terms, while the developer must design and develop something that meets the needs in terms of a real, efficient, and maintainable item of equipment.

Further, this is often complicated by language problems, personnel turnover, technology changes, priority
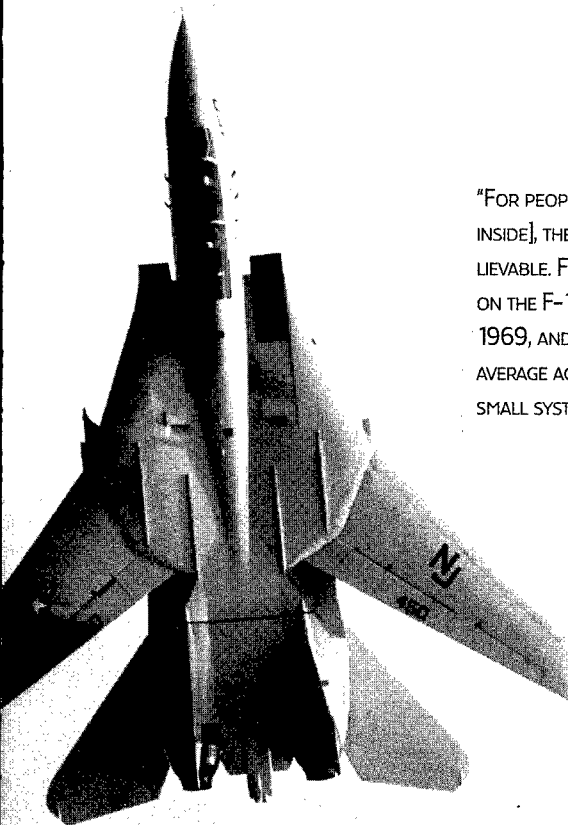
changes, and leadership directions. Of course, the real problem is that users really have a difficult task describing what the new requirement is; by nature, they want everything, they want it today, and they want it cheap! Who can blame them when they are representing the needs of the warfighters, who are always faced with new missions and bigger challenges. The problem is that this often ambitious, yet less-than-detailed Operational Requirements Document (ORD) is very difficult for developers to implement. In addition, as modelers develop many of the capabilities, technical solutions often end up as useful but not consistent with the original requirement. This is not always recognized, as the documentation of the original need is not usually available to the developers. A very long trail, indeed....

Documentation. When the acquisition of the training subsystem alone includes a trailer truckload of documents, it becomes easy to understand why the documentation of the acquisition life cycle is so difficult to manage and often lags behind when development work becomes overwhelming. Certainly, modern information technology can alleviate this problem, simply by automating the existing complex "paper" process. Making use of the current techniques of distributed data systems, electronic conferencing, and Web-based document collaboration would provide not only a ready access to the ORD, but also provide an online ability to document decisions and actions throughout the process. The idea that one phase of the process could pass its experience on to the next, including issues that need resolution and key decisions that help accomplish the requirement, would reduce the time and transfer loss that happens at each milestone. The use of consistent state-of-the-art information technology alone would reduce the process by 15-20 percent.

Simulation in Defining Concepts and Development of the ORD. Remember the hardest thing about doing a term paper in high school? Most of us would probably reply that it was determining the topic and theme of the paper. This process is similar to trying to describe the functional capabilities of a new weapons system, which has become especially difficult with the transition from a requirements-based system to a capability-based approach. One promising alternative approach that uses simulation is the development of a notional system using a dynamic computer model, at the component level of the systems. Modelers would begin by first loading the system that currently exists into a computer simulation that can dynamically and graphically display the appearance and performance capability of the components that make up the system. Depending on the complexity of the system, it could end up being a multi-level model, consisting of "system of systems." As most systems are actually only about 25 percent new technology, the combat developer systematically works through each major sub-system, replacing components with either existing components from other military or civilian systems, or defining a new system based on functional capability. Plugging the new items in, of course, must include a reconfiguration of support systems and recalibration of performance parameters.

Once the developer completes the functional virtual prototype, initial operational testing comes next to determine the prototype's performance capabilities. By injecting the Virtual Prototype into a battle scenario, previously baselined with the existing system, modelers can then see if they are achieving the desired outcomes. Data can be collected for those components that are real, and can be approximated for the completely new pieces. Once the concept is tried out, the performance parameters and the documented functionality can be translated into an ORD, and the virtual prototype can be passed on to the developer to ensure proper understanding of the requirements and maintenance of all the information generated up to this point. Of course, key to this process is ensuring that modelers use the new concepts in such a way that performance can be accurately measured and evaluated in terms of system and sub-system performance, as well as operational and tactical ability. This takes us to our next streamlining opportunity.

Test and Evaluation. Easily the most underutilized element of the overall acquisition community, test and evaluation could provide 25- to 40-percent savings if properly employed throughout the life cycle process. In the first place, most programs wait until the end to begin involving the test and evaluation (T&E) community when, in fact, the T&E experts should be on board from the very beginning. First, at the onset of the concept formulation process, the T&E experts – who understand data collection, performance assessment, and measures of effectiveness – can assist in the formulation process by pointing out those processes already tried, and those that cannot be accurately measured, as described. As the concept is converted into a prototype (hopefully, a virtual prototype as described previously), the T&E experts can help set up ways to measure the effectiveness of the prototype, as well as set up and measure the test program against the current baseline system. In some instances, they can provide facilities or, at the very least, insight, into how to conduct virtual tests, and can even do sophisticated hardware-in-the-loop, engineering-level developmental testing. At the same time, they can develop the test process so that data collected can be used for two other key elements related to Operational Testing – Verification, Validation, and Accreditation; and cost effectiveness. They should also be able to assist in leveraging data from previous developmental tests on notional components from other test activities, further reducing the need for testing. When this is coupled with information technology automation techniques, and information on test experience begins flowing between agencies using and reusing compo-

nent-level data and evaluation tools, the process becomes more efficient, and the life cycle becomes shorter.

A lack of valid data to use in the models, and the lack of facility most of us continue to have in truly working with data-intense decisions, constitute two of the most basic reasons simulation is not easier to implement. Pound for pound, the T&E community has lived in this world much longer than the rest of us, and we could benefit greatly from their experience.

Other Issues. Certainly, I could go on and talk about other areas that could benefit from M&S technology interventions. These could include the use of simulations for setting up virtual production lines; determining parts needs and stock levels; using simulation to simultaneously develop the necessary training systems; using the same notional approach described previously, with its resultant data trail to forecast RAM and logistics support and using a mix of the predecessor data and information available for the components connected together. This discussion could go on for quite some time. However, the examples I just cited should be enough to make the point that the use of simulation in acquisition is not a mysterious process, but rather the managed systematic integration of a new set of technology tools, in an innovative fashion. But, a few stumbling blocks, which are not technical but rather cultural and organizational, may impede the way.

The Problem

Presently, no focused, organizational method exists that ensures individuals are versed in the issues and methods surrounding M&S applications except by on-the-job training. Even within academia, only a few graduate degree programs in Simulation Systems are offered.[10,11] Despite this apparent lack of formal training and education, the need for DoD's expanded use of M&S continues to be viewed as a major solution, for the acquisition world and its activities continue to grow at a sig-

> # M&S is used everywhere in the Air Force because better decisions and better training make better warfighters.
>
> ## —1995 U.S. Air Force Modeling and Simulation Master Plan

nificant rate. Without a formal strategy for developing M&S professionals, neither consistent application nor functional standardization within the M&S community can be achieved, and acquisition will continue to go on as usual.

In addition, until the Federal Acquisition Regulation changes, many of the steps and streamlining options are, in fact, not allowed. Unless program managers receive sufficient latitude to employ these alternative techniques without the expectation that they must solely endure the pain and shoulder the risks, on those occasions when the fledgling technology fails, they will not take the risk. Only when the Departments sponsor key programs to do some classic side-by-side comparisons of applications using simulation versus traditional approaches, can the new technologies prove they will work, saving time and money. Then it will be possible to see Simulation Based Acquisition achieve its essential role.

Let me briefly take you back in history a few years. At the risk of sounding trite, our civilization is just beginning to shift from the Industrial Age to the Information Age; we are going through all the dynamic and sometimes painful

processes of change. If we look at how long it took our culture to go through the Industrial Revolution, we can imagine what's in store for us. Shifting from a focus on products and assembly-line thinking to information services and distributed collaboration, will clearly be a large leap. Planners, modelers, program managers, product managers — for many in our acquisition workforce, this shift in focus may not seem efficient or pleasant.

When we add these issues to the challenges resulting from the end of the Cold War and the huge push to expand to "operations-other-than-war" missions, our culture is going through an era that makes the '60s look positively calm. Only by systematic planning and careful application of new technologies, with an eye always toward the best outcome, can this process be streamlined and acquisition become one of the domains that makes full use of available technology.

E N D N O T E S
1. The Army Model and Simulation Master Plan (Headquarters, Department of the Army, 1994).
2. Ibid.
3. The U.S. Air Force (USAF) Modeling and Simulation Master Plan (HQ USAF/XOM, 1996).
4. Ibid.
5. Marine Corps Modeling and Simulation Management Office, 1995.
6. Ibid.
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8. Slatkin, N., "Policy for Modeling and Simulation"; available at http://sneezy.nosc.mil/30_org/3Files/TSG/ASNONMNS.html (Memorandum, 1995).
9. Kistler, J.R., "Navy Modeling and Simulation." Presentation given at the Defense Modeling and Simulation Office (Washington, D.C., 1996).
10. Graduate Degree Program established at University of Central Florida, 1994.
11. Graduate Degree Program established at Naval Post Graduate School, 1996.

Air Force Modeling and Simulation Trends

Modeling and Simulation Makes Possible the Unaffordable

WILLIAM K. MCQUAY

Modeling and Simulation (M&S) is already an integral part of the way the Air Force conducts business. Current use of M&S by Department of Defense (DoD) program and product managers extends throughout the Air Force; from research, development, acquisition, and sustainment, to training and operations (Figure 1).

The New M&S Vision

The Air Force envisions an integrated, common M&S environment that will be accessed by analysts, warfighters, developers, and testers supporting the range of Air Force tasks, from determining requirements through conducting operations. This article summarizes trends in the new vision for M&S and in the simulation technology that can be employed to implement simulation systems of the future. Joint M&S standards will provide key advanced technologies for future simulation applications.

Throughout the rest of the decade, the use of M&S will increase throughout all functional areas in the DoD. Because of increased technical capability and increased fiscal constraint, including DoD-mandated budget reductions in other areas, M&S utilization will continue to expand. Further, M&S allows DoD organizations to do things that would otherwise be unaffordable (i.e., thousands of parametric
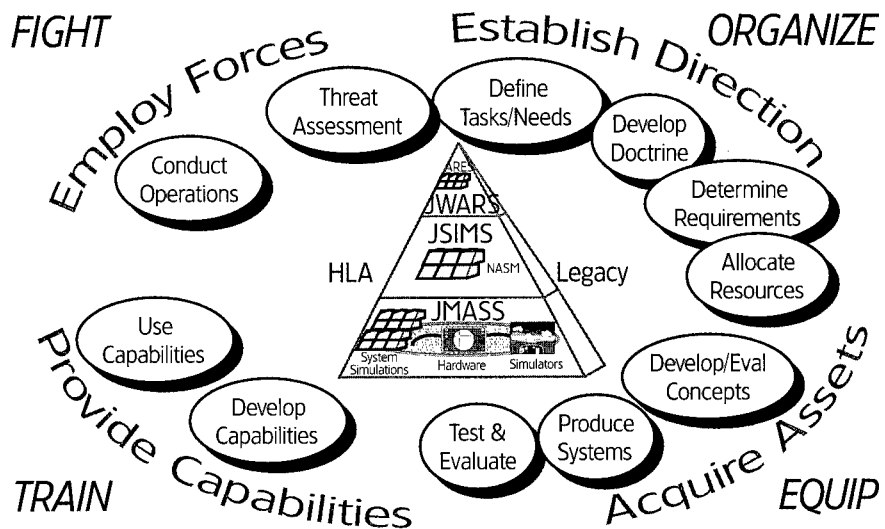

Figure 1. **M&S in the Air Force Enterprise**

sensitivity tests on new systems) or physically difficult-to-accomplish military worth studies on proposed force structures against threat command and control systems).

Recognizing the importance of M&S, the Department issued a DoD Directive on "DoD Modeling and Simulation Management," that provides for a DoD M&S Master Plan. As part of the Master Plan, DoD established a common, High Level Simulation Architecture to assure not only the appropriate interoperability of simulations, but their interface with command, control, communications, computers, and intelligence (C^4I) systems. The goals of

the High Level Architecture (HLA) include several areas:

- Interoperability
- Reuse
- Portability
- Distributed Operation
- Legacy Operation
- Scalability
- Broad Applicability
- Technological Evolvability
- Commercial Off-the-Shelf (COTS) Products
- Government Off-the-Shelf (GOTS) Products

DoD adopted the last two goals as part of its acquisition reform strategy to

McQuay is Chief, Simulation Technology Branch, System Concepts and Simulation Division, Avionics Directorate, U.S. Air Force Wright Laboratory, Wright-Patterson Air Force Base, Ohio. He directs the Electronic Concepts Simulation Research Laboratory and has over 25 years' experience in research for advanced simulation technology. McQuay currently chairs an Avionics Directorate Integrated Product Team, which is defining and implementing a Collaborative Engineering Environment (CEE) for laboratory-wide use and application of virtual prototyping.

make maximum feasible use of off-the-shelf products.

Today's simulations are narrowly focused, stovepiped developments for each user community. Specifically, they do not fully meet Joint needs; take too long to build; cost too much to build and operate; lack verification, validation, and accreditation; are not interoperable with each other's M&S assets; and are not easily maintainable or extensible. High-level DoD and Air Force senior acquisition managers share a consensus view on the need to interoperate and reuse models, simulations, and related products across Service lines; across traditional communities (e.g., linking models and simulations to C⁴I systems); across functions (e.g., sharing capabilities between operations and acquisition); and across classes of models and simulations (e.g., linking live, virtual, and constructive simulations).

The effective use of models and simulations across DoD requires a common technical framework for M&S to

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ensure interoperability and reuse. Embodied in this technical framework will be a common HLA to which models and simulations must conform; conceptual models of the mission space to provide a basis for the development of consistent and authoritative simulation representations; and data standards to provide common representations of data across models, simulations, and C⁴I systems.

Air Force program and product managers are in general agreement that no single model or simulation system can satisfy all uses and users. Further definition and detailed implementation of the specific simulation system architectures, which will be HLA-compliant, will remain the responsibility of the developing Service or Agency. The HLA will specify only the minimum definition required to facilitate interoperability and reuse. The DoD HLA is central to the M&S Master Plan.

One way to view this simulation HLA is to think of a city planner or architect. A building is compliant as long as
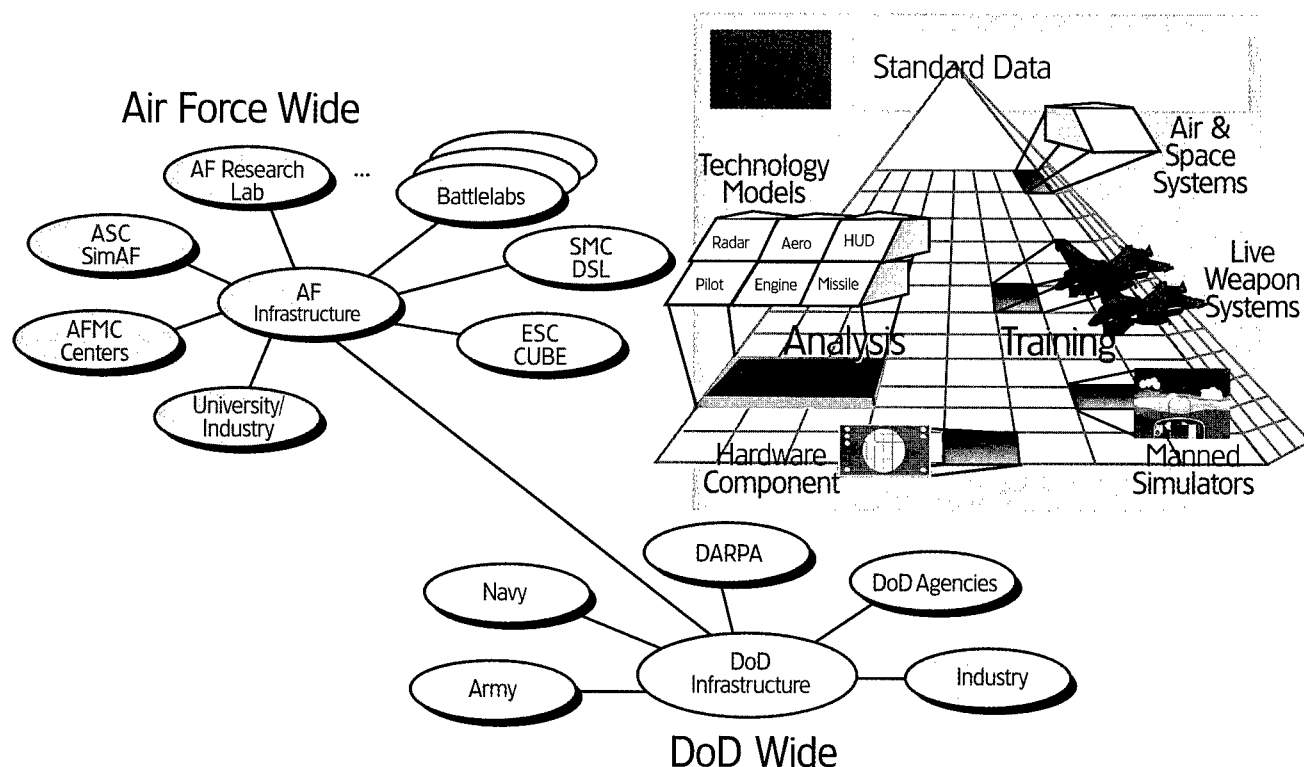

Figure 2. **Joint Synthetic Battlespace**

Simulated Squadron · **Digital System Models** · **Technology Models** · Avionics · Aero · Munitions · Devices · Engine · Material · **Manned Simulator** · Hardware Component · JMASS JSIMS JWARS · Campaign · Mission · Engagement / Sub-mission · System / Component · Science & Technology Base
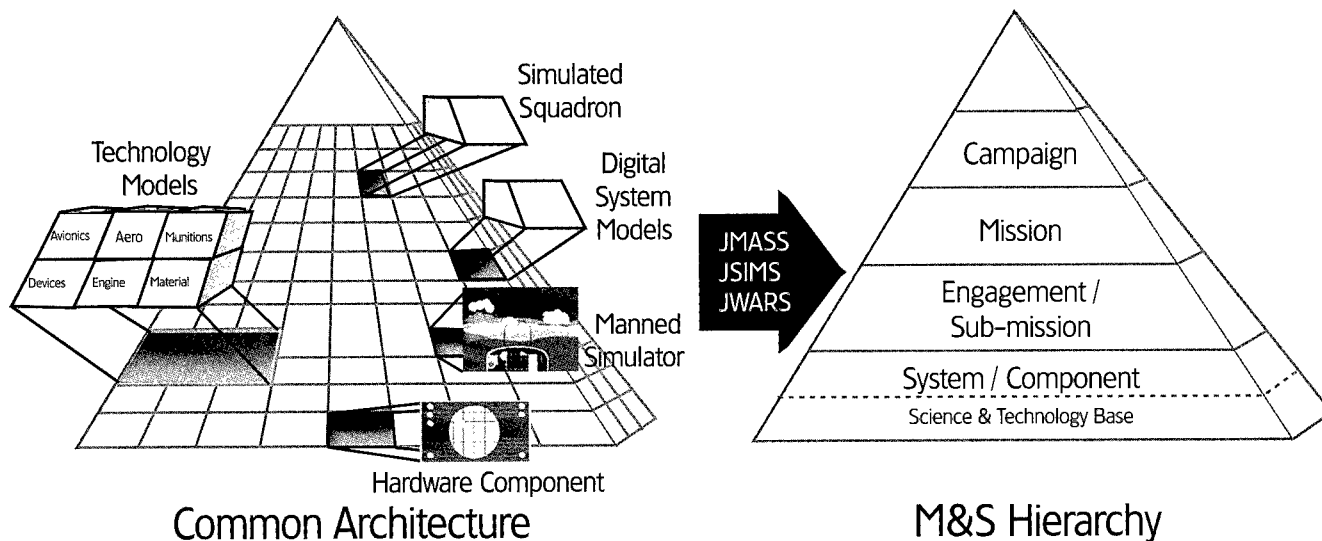
Common Architecture   M&S Hierarchy

Figure 3. **The Air Force M&S Architecture**

you get the right permits and follow the building codes and standards. Similarly, new models would be required to follow specific standards to fit within a certain general architecture. The DoD M&S Master Plan and subsequent DoD directives require a review and oversight of all ongoing DoD M&S projects and programs for compliance with the HLA and phase-out of non-compliant programs by FY 01.

A New Vector for Air Force M&S

Consistent with the DoD vision, the Air Force envisions an integrated, common M&S environment accessed by analysts, warfighters, developers, and testers; and supporting the range of Air Force tasks, from determining requirements through conducting operations. On June 9, 1995, the Air Force convened an Air Force Four Star M&S Summit to create an M&S roadmap. The resultant roadmap defines a future vision for Air Force simulation and describes near-term and mid-term goals. Achievement of those goals is expected to move the Air Force closer to M&S commonality; and also a consistent representation of aerospace forces for Joint use.

The key concept in the Air Force M&S vision is the Joint Synthetic Battlespace — an integrated M&S environment, connecting analysis and training and

tying together many types of simulation (Figure 2). The simulations extend from high-level aggregate models to detailed engineering models; from pilots in live aircraft and simulators, to hardware components and laboratory test beds.

The Air Force M&S infrastructure focuses on three key initiatives:

- **Joint M&S Integration Program** (JMSIP) — a coordinated approach to improving air and space representation in our legacy models and simulations while consolidating into fewer models that meet the requirements of many.
- **Joint Standards** — a commitment to Joint M&S developments with supporting Air Force initiatives.
- **Advanced Distributed Simulation Leveraging** — programs to provide high-speed connectivity between Air Force installations, multiple networked air combat training simulators for each wing in the Air Force, and a synthetic battlespace for Joint Force Air Component Commanders.

In the near-term, JMSIP will focus on the need to corporately address M&S improvements and the need to encourage consolidation. Addressing these two vital needs will serve as a leveraging effort, producing an Air Force

M&S Roadmap that maximizes common efforts and targets improvements based on a corporate assessment of their importance and urgency.

For the mid-term and in accordance with overall DoD direction, the Air Force will implement simulation standards through defined architectures and simulation systems that support them. Each product center has or is developing a portal into the Joint Synthetic Battlespace of the future for *system of systems* evaluations and a key part of the current Air Force M&S infrastructure — Aeronautical Systems Simulation Analysis Facility (SimAF), Electronic Systems Command and Control Unified Battle Environment, and Space and Missile Center's Decision Software Laboratory.

In addition to key facilities, M&S standards will generate greatly improved simulation interoperability, allowing the Air Force to leverage simulation investments. The Air Force has targeted three major simulation standards efforts in the roadmap for high-level Air Force oversight and investment. All will participate and adhere to the DoD High Level Simulation Architecture initiatives being directed by the Director, Defense Research and Engineering, and managed by the Defense Modeling and Simulation Office:
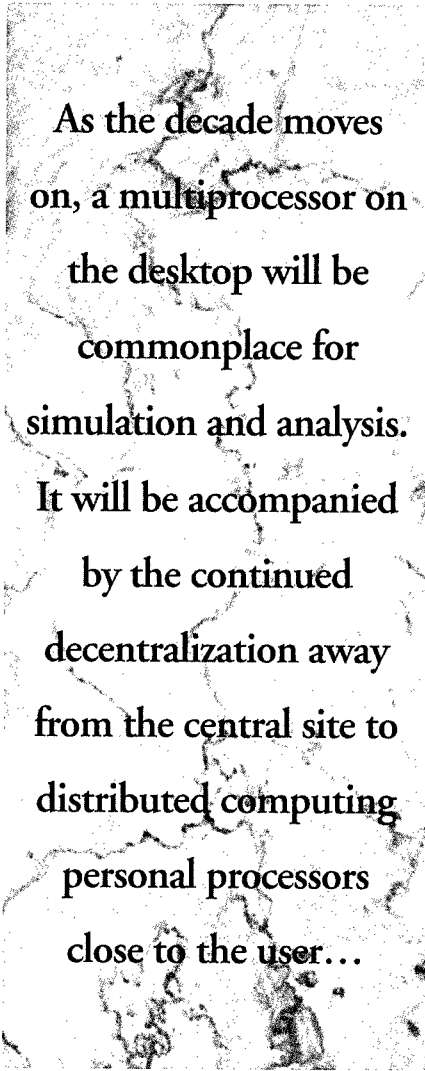
- The Joint Simulation System (JSIMS) is a distributed, object-oriented simulation architecture and system focused on the *operational level of war* (campaign and mission level simulation).
- The Joint Warfare Simulation (JWARS) focuses on Joint campaign analysis.
- The Joint Modeling and Simulation System (JMASS) is an Air Force-directed program to develop and deliver a distributed, object-oriented simulation architecture and system focused on the *tactical level of war* (mission and engagement simulations).

These Joint standards and the systems that support them will enable interoperability and reusability of Air Force M&S tools across key communities and processes. The Joint standards serve as GOTS frameworks for the addition of third-party applications. These initiatives, coupled with ongoing improvements and standards, will bring the Air Force measurably closer to the objective of a common, integrated M&S system (Figure 3).

Computer and Simulation Technology Trends

The changes reported in this article and resultant revision in the DoD and Air Force M&S visions, motivated by changes in computer and simulation technology, reflect current trends throughout the DoD. In the past decade, computer hardware technology improved several orders of magnitude: microprocessor speed alone increased about 100-fold. The overwhelming trend is faster, smaller, and cheaper. This reduction in cost and size, coupled with an increase in speed and capacity, resulted in a massive increase in simulation capability. Computational power continues to increase as prices decrease.

As the decade moves on, *a multiprocessor on the desktop* will be commonplace for simulation and analysis. It will be accompanied by the continued decentralization away from the central site to distributed computing personal

> As the decade moves on, a multiprocessor on the desktop will be commonplace for simulation and analysis. It will be accompanied by the continued decentralization away from the central site to distributed computing personal processors close to the user...

processors close to the user, mixed with computationally intensive servers on a heterogeneous network.

Object-oriented (OO) software technology is having a major impact on simulation technology as well as software in general. For software developers, OO software addresses three major problems: iterative development, reuse, and maintenance. Since up-front requirements definition is difficult, many successful OO projects employed an evolutionary, iterative process for development. Object-orientation can also promote reuse through a library of reusable objects. When combined with reuse and visual programming, OO technology can increase productivity, and therefore lower cost and decrease time for software development.

Software development has been historically labor-intensive. To date, even computer aided software engineering tools have not dramatically increased productivity. Producing the needed improvement will require a major paradigm shift.

OO technologies, combined with visual approaches and an engineering discipline to software development via a software structural model methodology, can finally bring the needed breakthrough. OO technology will allow implementation of component-based software as the construct for software reuse. By employing component-based design, users can be divided into four roles:

- **Appliers** – configure input data and execute existing simulations.
- **Assemblers** – establish connections among component parts found in a reuse library to build simple custom applications or models without professional programming assistance.
- **Power Assemblers** – go beyond piecing component parts together by implementing more complex logic.
- **Fabricators** – build new component parts

Advanced User Interfaces will extend the now common Graphical User Interface into an agent-based multisensor user interface that will incorporate features such as voice synthesis and voice recognition. Future computer software architectures will incorporate Manager-Agent and Remote Programming. In Manager-Agent programming, the client computer sends an object that the server executes. The object is called an agent because it acts on behalf of the sending computer. In Remote Programming, the client and server can interact independently of the network once the network transports the agent to the server. These intelligent agents act like assistants rather than tools: they will show more initiative, assume responsibility for larger subtasks, and take appropriate risks (rather than confirming every detail with the user).

As computer and software technologies advance, they change the face of modeling and simulation. Simulation technology has evolved from stand-alone models, to model hierarchies, to an integrated modeling system (Figure 4).

Future advanced modeling systems will include the following characteristics:

- Open systems architecture supporting applications conforming to commercial and industry standards.
- Visual paradigm – visual programming, visual assembly, visualization of output results.
- Object-based to allow component reuse.
- Extensible architecture for future software concepts.
- Web-based, browser-type user interface on the desktop.
- Execution on distributed heterogeneous network of workstations and upscale PCs.
- Tools to support development of model components.
- Multiple language support – the user can specify the target source language (C, C++, Objective C, Java, Ada83, Ada95, VHDL, etc.).
- Object-oriented database.
- Tools and models support a "Plug and Play" concept.
- Supports "distributed model development" by the domain experts as opposed to central model development by software experts.
- Provide a repository of models and their components.
- Documentation designed to support software reuse.
- Verification, Validation, and Accreditation (VV&A) integral to the software development.
- Compliant with the DoD High Level M&S Architecture.

The future vision for Air Force simulation is a flexible, integrated simulation environment that supports the full range of Air Force activities. Revolutionary and evolutionary advances in computer and software technology provide significant opportunities to implement this modeling and simulation vision.

Summary

The future vision for Air Force simulation is a flexible, integrated simulation environment that supports the full range of Air Force activities. Revolutionary and evolutionary advances in computer and software technology provide significant opportunities to implement this modeling and simulation vision. The new M&S technologies will permit the creation of simulations tailored to the user's need, at a greatly reduced cost in time and money, and with elements of proven quality. Admittedly, achieving the simulation vision will require patience, perseverance, and significant investment to overcome many challenging problems, but the potential payoff is extremely high.
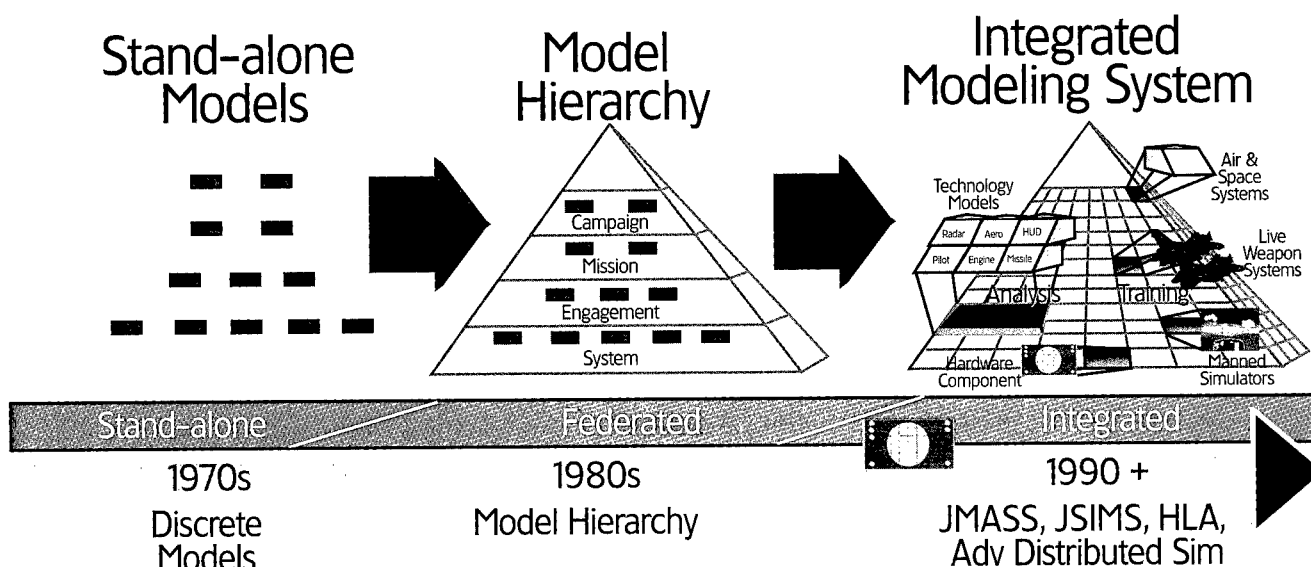
Figure 4. **Evolution of Simulation Technology**

ACQUISITION REFORM

An Internet Listing Tailored to the Professional Acquisition Workforce

Surfing the Net

Under Secretary of Defense (Acquisition and Technology) (USD[A&T])
http://www.acq.osd.mil/HomePage.html
Helps locate a specific office or USD (A&T) document.

Deputy Under Secretary of Defense (Acquisition Reform) (DUSD[AR])
http://www.acq.osd.mil/ar
Information on upcoming events, legislation, and DUSD(AR) organizational breakout. "Ask A Professor" link allows users to ask questions and receive responses within 10 business days.

Acquisition Systems Management (Defense Acquisition Board [DAB] Executive Secretary)
http://www.acq.osd.mil/api/asm/
Information on organization, mission, products, customers, and Frequently Asked Questions (FAQ).

DoD Acquisition Workforce Home Page
http://www.dtic.mil/acqed2/acqed.html
Current legislation, regulations, critical acquisition positions, and FAQs for the acquisition workforce.

Defense Acquisition Deskbook
http://www.deskbook.osd.mil
Automated acquisition reference tool covering mandatory and discretionary practices as well as procurement wisdom.

Defense Acquisition University (DAU) and Acquisition Reform Communications Center (ARCC)
http://www.acq.osd.mil/dau
DAU course and schedule information; consortium school links; acquisition documents and publications. ARCC provides Acquisition Reform training information and materials.

Army Acquisition Corps (AAC)
http://dacm.sarda.army.mil
News; policy; publications; training opportunities.

Navy Acquisition Reform
http://www.acq-ref.navy.mil/
Policy and guidance; resource lists; tools; training opportunities.

Air Force (Contracting)
http://www.hq.af.mil/SAFAQ/contracting/
Business opportunities with the Air Force; various training options; library of publications.

Air Force (Acquisition)
http://www.safaq.hq.af.mil/
Shop Talk; "Ask AQ" and receive answers within two business days.

Air Force Materiel Command (AFMC) Contracting Laboratory's Federal Acquisition Regulation (FAR) Site
http://farsite.hill.af.mil/
FAR search tool; information on open FAR and Defense Federal Acquisition Regulation (DFAR) cases; Federal Register; *Commerce Business Daily* Announcements; Electronic Forms Library.

HQ AFMC/PK Training
http://www.afmc.wpafb.af.mil/
Access "Organizations," "PK Contracting," "PKX, Resource Management," and "Training" to obtain Air Force training references, tools, guidebook, and link to Lightning Bolt #9 Training.

Centralized Request for Proposal (RFP) Support Team Office
http://www.crfpst.wpafb.af.mil/
Acquisition Strategy Panel (ASP) Secretariat; Lightning Bolt information; announcements and events; sample documents and more!

Defense Advanced Research Projects Agency (DARPA)
http://www.arpa.mil
Planned procurement examples available for downloading.

Defense Information Systems Agency (DISA)
http://www.disa.mil
Structure and mission of DISA; products and services; contracting opportunities.

Defense Systems Management College (DSMC)
http://www.dsmc.dsm.mil
DSMC educational products and services.

National Imagery and Mapping Agency (NIMA) (Formerly Defense Mapping Agency) (DMA)
http://www.nima.mil
Geospatial and imagery information; publications; business opportunities.

Defense Modeling and Simulation Office (DMSO)
http://www.dmso.mil
Focal point for information concerning DMSO activities.

Defense Technical Information Center (DTIC)
http://www.dtic.mil/
Information on planned, ongoing, and completed defense-related research.

DoD Electronic Commerce/Electronic Data Interchange Office (EC/EDI)
http://www.acq.osd.mil/ec/
Information on Central Control Register; Value Added Networks; current EDI sites; online resources.

Open Systems Joint Task Force
http://www.acq.osd.mil/osjtf
Open Systems education and training opportunities; standards selection; documentation; key briefings; evidence of benefits.

Government Education and Training Network (GETN)
(for Department of Defense only)
http://www.afit.af.mil/Schools/DL/schedule.htm
Schedule of distance learning opportunities

Government-Industry Data Exchange Program (GIDEP)
http://www.gidep.corona.navy.mil
Information on non-conforming products; diminishing manufacturing sources; engineering; metrology; reliability-maintainability for better readiness and reduced costs.

DoD Acquisition Workforce Personnel Demonstration Project
http://www.crfpst.wpafb.af.mil/demo/homepage.html
Information on the demonstration project, including documents, FAQs, and related sites.

ACQUISITION REFORM

An Internet Listing Tailored to the Professional Acquisition Workforce

Surfing the Net

FEDERAL CIVILIAN AGENCIES

ARNET (Joint Effort of the National Performance Review and Office of Federal Procurement Policy)
http://www.arnet.gov/
Virtual library; procurement resources; best practices; business opportunities.

Federal Acquisition Institute (FAI)
http://www.gsa.gov/staff/v/training.htm
One-stop acquisition training shop; Federal Acquisition Streamlining Act resource materials; FAR; Federal Acquisition Reform Act.

Federal Acquisition Jump Station
http://procure.msfc.nasa.gov/fedproc/home.html
Procurement and acquisition servers by contracting activity; CBDNet; Reference Library; Small Business Assistance; Electronic Commerce; Streamlining.

General Accounting Office (GAO)
http://www.gao.gov
Investigative arm of Congress; examines matters relating to the receipt and disbursement of public funds. Allows users access to GAO reports, FAQs.

General Services Administration (GSA)
http://www.gsa.gov
Online shopping for commercial items to support government interests.

Library of Congress
http://www.loc.gov
List of public laws; legislation; vetoed bills; Congressional Internet services.

National Performance Review (NPR)
http://www.npr.gov/
Government cost-savings advice; "how to" tools.

National Technical Information Service (NTIS)
http://www.fedworld.gov/preview/preview.html
Check out OrderNow for online products.

Small Business Administration (SBA)
http://www.SBAonline.SBA.gov
Communications network for small businesses.

U.S. Coast Guard
http://www.dot.gov/dotinfo/uscg/welcome.html
General Coast Guard information.

INDUSTRY AND PROFESSIONAL ORGANIZATIONS

Aerospace Industries Association
http://www.access.digex.net
Information about the most critical issues facing today's U.S. aerospace industry and access to related Internet sites.

Commerce Business Daily
http://www.govcon.com/
Access to current and back issues with search capabilities; business opportunities; interactive yellow pages.

Consortium for Advanced Manufacturing—International
http://www.onramp.net/cami
Activities of this non-profit manufacturing research organization include activity-based costing and activity-based management.

Electronic Industries Association (EIA)
http://www.eia.org
Government Relations Department includes links to issue councils.

National Contract Management Association (NCMA)
http://www.ncmahq.org
"What's New in Contracting?"; educational products catalog.

Society of Logistics Engineers (SOLE)
http://www.sole.org/
Online desk references that link to advice in solving logistics problems.

TOPICAL LISTINGS

ACQWEB Index of Offices by Title
http://www.acq.osd.mil/acqweb/topindex.html
Great launch pad to acquisition-specific sites and topics.

DoD Specifications and Standards Home Page
http://www.acq.osd.mil/es/std/stdhome.html
Military standards and specifications reform;

FAQs; key POCs; standardization library (newsletters, policy memos, and other documents); training, seminars and conferences; commercial and nondevelopmental item programs.

Earned Value Management
http://www.acq.osd.mil/pm
Information on implementation of Earned Value Management, including latest policy changes, standards, international developments, and an active noteboard.

FAR, Circulars, and Supplements from GSA
http://www.gsa.gov/far
The latest FAR information and specific references.

Fedworld Information
http://www.fedworld.gov
A comprehensive central access point for searching, locating, ordering, and acquiring government and business information.

GSA Advantage
http://www.fss.gsa.gov
Assistance in using the government-wide purchase card.

Single Process Initiative (SPI) Information
http://www.dcmc.dcrb.dla.mil
SPI policy, guidance, procedures; information sheets, lessons learned.

If you have questions about the above sources, or would like to add your Website to this list, please call the Acquisition Reform Communications Center (ARCC) at 1-888-747-ARCC. DAU encourages the reciprocal linking of its Home Page to other interested agencies. Contact the DAU Webmaster at: **dau_webmaster@acq.osd.mil**

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Office of the Press Secretary

For Immediate Release   August 1, 1997

PRESIDENT CLINTON NAMES JACQUES GANSLER
AS UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND TECHNOLOGY

President Clinton today announced his intent to nominate Jacques Gansler as Under Secretary of Defense for Acquisition and Technology.

Dr. Gansler, of McLean, Virginia, is Executive Vice President and Director at TASC (an applied information technology company), where he has been since 1977. Prior to that, he was Deputy Assistant Secretary of Defense for Material Acquisition; Assistant Director of Defense Research and Engineering (Electronics). Dr. Gansler also has extensive experience in the private sector. He served as Vice President at I.T.T. and as Program Manager at the Singer Corporation. Dr. Gansler was also involved in Engineering Management at the Raytheon Corporation. He is currently the Vice Chair of the Defense Science Board. Dr. Gansler received his B.E. in Electrical Engineering from Yale University, his M.S. in Electrical Engineering from Northeastern University, his M.A. in Political Economy from New School for Social Research, and his Ph.D. in Economics from the American University.

As Under Secretary for Acquisition and Technology, Dr. Gansler will be the principal staff assistant to the Secretary for all matters relating to the acquisition of weapons and material, including research and development, testing and evaluation, production, logistics, military construction, and procurement.

Editor's Note: Dr. Gansler's nomination now goes to the U.S. Senate for confirmation.

FROM THE COMMANDANT

We're extremely pleased to present Gary Smith, the Special Operations Command Acquisition Executive (SOCOM AE), as our cover story for this issue (p. 2). Since Gary's appointment as the SOCOM AE in 1991, we've had the pleasure of hosting him at the College on numerous occasions. His unique position as manager of the entire acquisition program for American Special Forces is a story you won't want to miss reading.

We have a new senior leader in the acquisition community, and DSMC can claim him as one of our own (p. 39). Effective July 7, Army Lt. Gen. Paul J. Kern became the new Military Deputy to the Assistant Secretary of the Army for Research, Development, and Acquisition. A 1982 graduate of DSMC's Program Management Course [now called the Advanced Program Management Course], General Kern will also serve as the Director, Army Acquisition Corps. Please join us in welcoming him to the ranks of our DoD senior acquisition leaders.

Modeling and Simulation (M&S) is the predominant theme throughout this issue. We're extremely privileged in that Dr. Patricia Sanders, the Director, Test, Systems Engineering and Evaluation (DTSE&E) for the Department of Defense, wrote the lead article in this series (p. 72). Dr. Sanders is responsible for ensuring the effective integration of all engineering disciplines into the system acquisition process, including modeling and simulation.

Preceding Dr. Sanders' article, we announce the publication of an important document for DoD and its M&S community: *Simulation Support Plan Guidelines*, May 1997 (p. 69). These guidelines, along with Acting Under Secretary Longuemare's OSD "Study on the Effectiveness of M&S in the Weapon System Acquisition Process," provide a tremendous wealth of information on M&S use in current projects and programs.

From a cornfield in New Jersey to a simulation superstructure in Orlando, these M&S articles — solicited from a broad spectrum of all three Services, other government agencies, and the academic community — provide an excellent overview of current DoD use of M&S and its potential for the future.

Also in this issue we present an in-depth look at program stability (p. 59) from Dan Czelusniak, Director, Acquisition Program Integration, OUSD(A&T). Look for an upcoming interview with Dan in our November/December 1997 issue.

On June 16, we conducted a trial run of *PictureTel*, our new Video TeleTeaching (VTT) system (p. 40). This marks an important milestone toward achieving one of our major strategic goals — *Distance Learning* (1997 DSMC Corporate Plan). Our thanks to Rear Adm. George Wagner, Commander, SPAWAR, for his cooperation and support of our Technology-Based Education and Training initiative.

Also in this issue we bring you the proceedings of the 1997 Acquisition Research Symposium, a biannual event we co-host with the National Contract Management Association (p. 20). This year's event was held June 25-27 in Rockville, Maryland. On p. 48, you'll also find an article covering the Ninth International Acquisition/ Procurement Seminar sponsored by the International Defense Educational Arrangement (IDEA), in Mannheim, Germany, July 9-11.

Continuing our series of articles on the DAU consortium schools, this issue highlights the Naval Postgraduate School (p. 10) and DSMC's Western Region (p. 52).

By now, we've all learned of the White House nomination of Dr. Jacques Gansler as Dr. Kaminski's successor (White House Press Release, opposite page). While Dr. Gansler awaits Senate confirmation, the Principal Deputy Under Secretary, R. Noel Longuemare, continues as the Acting USD(A&T). Be assured we'll be publishing the new Under Secretary's programs, priorities, and future goals very soon.

Here at the College, we recently celebrated the graduation of 241 students from the Advanced Program Management Course (APMC 97-2). This class graduated on August 15, and on September 8 we'll be welcoming the students of APMC 97-3. Although we've conducted many graduations for our PMC and APMC students over the years, the satisfaction of knowing we're making a difference and our students are going out and achieving results, never wanes.

Secretary of Defense Cohen, in this issue (p. 16) speaks of not only a revolution in military affairs, but a revolution in the Department's business practices. DSMC graduates of the caliber of John Douglass and Paul Kern are among the first to emerge as leaders in this acquisition revolution. Many more of our graduates have yet to reach their zenith, but each of them is making a positive difference to DoD's acquisition process.

DAU and its consortium schools are now graduating the finest acquisition professionals in the world. For our faculty and staff, it's a tremendous sense of accomplishment, only surpassed by our desire to make a quality acquisition education accessible to as many members of the professional acquisition workforce as possible, as soon as possible.

—**Brig. Gen. Richard A. Black**
U.S. Army
Commandant

PM